July-August 1981
Volume 25
Number 4

Mariners Weather Log

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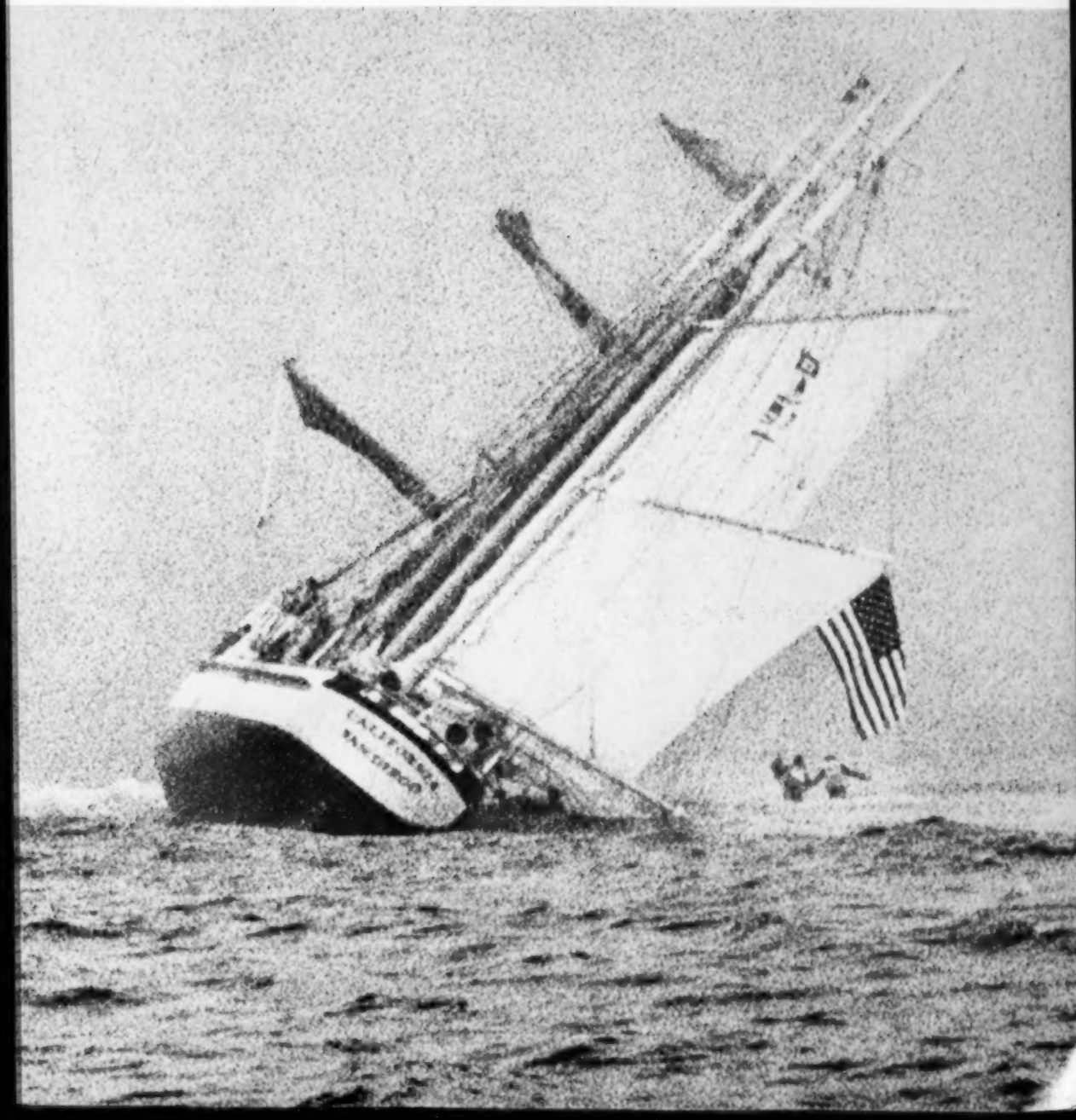

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Cover: The barkentine CALIFORNIA hard aground on its side. The vessel ran aground in heavy fog off San Diego on February 15. At right, two of the 54 passengers and crew can be seen wading ashore. Wide World Photo.

ARTICLES
231 Some characteristics of Atlantic tropical cyclone forecast errors
237 Western North Pacific typhoons, 1980

HINTS TO THE OBSERVER
253 Wind direction bias

TIPS TO THE RADIO OFFICER
254 National Weather Service CW communication policy
255 New edition of Worldwide Marine Weather Broadcasts to be available soon
255 Corrections to Worldwide Marine Weather Broadcasts (June 1980 Edition)

MARINE OBSERVATIONS PROGRAM
255 Communications
255 Coastal observations

HURRICANE ALLEY
257 Southern Hemisphere, March and April 1981
258 Global tropical cyclones, March and April 1980
259 Tropical cyclone watch - 1981

ON THE EDITOR'S DESK
259 A new kind of storm
259 Guide to marine science acronyms
260 New Pacific marine facsimile products
260 Satellites shunted, shifted, and launched
260 Seattle PMO moves
260 Improved NOAA satellite launched
260 Great Lakes buoy network
261 Lightning

MARINE WEATHER REVIEW
262 Smooth Log, North Atlantic Weather, January and February 1981
267 Smooth Log, North Pacific Weather, January and February 1981
273 Principal tracks of centers of cyclones at sea level, North Atlantic, January 1981
274 Principal tracks of centers of cyclones at sea level, North Atlantic, February 1981
275 Principal tracks of centers of cyclones at sea level, North Pacific, January 1981
276 Principal tracks of centers of cyclones at sea level, North Pacific, February 1981
277 U.S. Ocean Buoy climatological data, January and February 1981
283 Selected Gale and Wave observations, North Atlantic, January and February 1981
284 Selected Gale and Wave observations, North Pacific, January and February 1981
290 U.S. Cooperative Ship weather reports, January and February 1981
292 Rough Log, North Atlantic Weather, April and May 1981
298 Rough Log, North Pacific Weather, April and May 1981

MARINE WEATHER DIARY
304 North Atlantic, August
304 North Pacific, August
305 North Atlantic, September
305 North Pacific, September

308 Addresses of Port Meteorological Officers

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1983.

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Mariners Weather Log

SOME CHARACTERISTICS OF ATLANTIC TROPICAL CYCLONE FORECAST ERRORS

Charles J. Neumann
National Hurricane Center[1]
Coral Gables, Fla.

Relevant to the responsibility of detecting, tracking, and forecasting tropical cyclones, the National Hurricane Center (NHC) continuously monitors the quality of its forecast products. Through computer technology, the hurricane specialists at NHC are kept constantly aware of errors as they develop following advisory issuances to various interests. Error summaries are prepared on individual forecasts as well as on a storm-by-storm basis. Finally, at the end of each hurricane season, an overall seasonal summary of errors is prepared.

Periodically, performance is examined over a number of hurricane seasons to identify any long-term biases, deficiencies in performance, trends or other patterns in the forecasts. In one such recent evaluation, Neumann and Pelissier (1981) examined approximately 1,000 forecasts of tropical cyclone motion issued by NHC over the 10-yr period 1970-1979. Portions of that study which pertain to 12- and 24-hr forecasts and of interest to mariners are presented here.

[1]Study partially supported by NOAA/ERL National Hurricane Research Laboratory (NHRL)

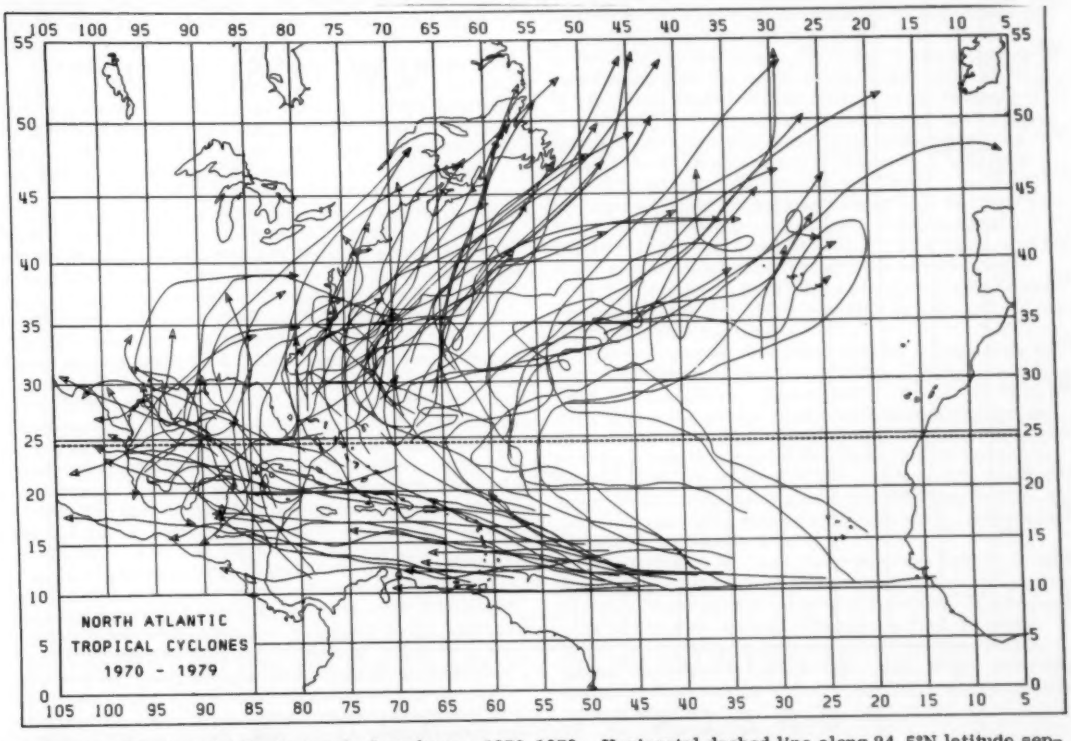

Figure 1.--Tracks of Atlantic tropical cyclones, 1970-1979. Horizontal dashed line along 24.5°N latitude separates north-zone from south-zone storms. (From Neumann and Pelissier, 1981)

FORECAST ERRORS

Marine advisories on tropical cyclones are issued every 6 hr whenever such storms are in existence. Along with other information these advisories contain 12- and 24-hr forecast positions of the tropical cyclone center (eye). It was these 12- and 24-hr forecasts that were examined.

The usual measure of tropical cyclone forecast accuracy is given by the quantity forecast error or, if averaged over a number of events, as mean forecast error. This error is simply the distance in nautical miles, measured along a great circle, between the forecast and actual positions of a tropical cyclone center. The actual position is obtained from a final storm track as determined by a postanalysis of all available satellite, aircraft, radar, ship, island, data buoy, and coastal reports. This final track is referred to as the "best-track" of the storm. Maps of seasonal best-tracks appear annually in the Mariners Weather Log; the chart for 1980, for example, is contained in the summary article of 1980 tropical cyclones (Lawrence and Pelissier, 1981).

Over the 10-yr period 1970-1979, 82 tropical storms and hurricanes were recorded over the Atlantic basin. The tracks of these storms are shown in figure 1. A total of 1,113 12-hr forecasts and 975 24-hr forecasts on these tracks were issued routinely at 6-hr intervals by NHC with average errors of 51 and 109 mi, respectively. As would be expected, there were wide variations in individual errors, ranging from 0 to 208 mi at 12-hr and 0 to 449 mi for the 24-hr forecast. The actual distribution of errors is depicted in figure 2. The figure shows, particularly at 24 hr, that an otherwise reasonably acceptable pattern of error is marred by occasional errors of unacceptable magnitude. The remainder of this discussion will consider factors which relate to this large variation in error from one forecast to another.

FACTORS WHICH INFLUENCE FORECAST ERROR

Although 12- and 24-hr tropical cyclone forecast errors averaged 51 and 109 mi, respectively, there were wide geographical variations depending on a number of factors which relate to the difficulty of the forecast. One such factor is latitude. For example, 12- and 24-hr errors on storms initially located (last known position for beginning of the forecast interval) in the south zone of figure 1 were 43 and 88 mi, respectively, whereas those initially in the north zone averaged 56 and 124 mi, respectively. For the most part, storms located in the south zone were embedded in the easterly (trade wind) circulation, whereas those

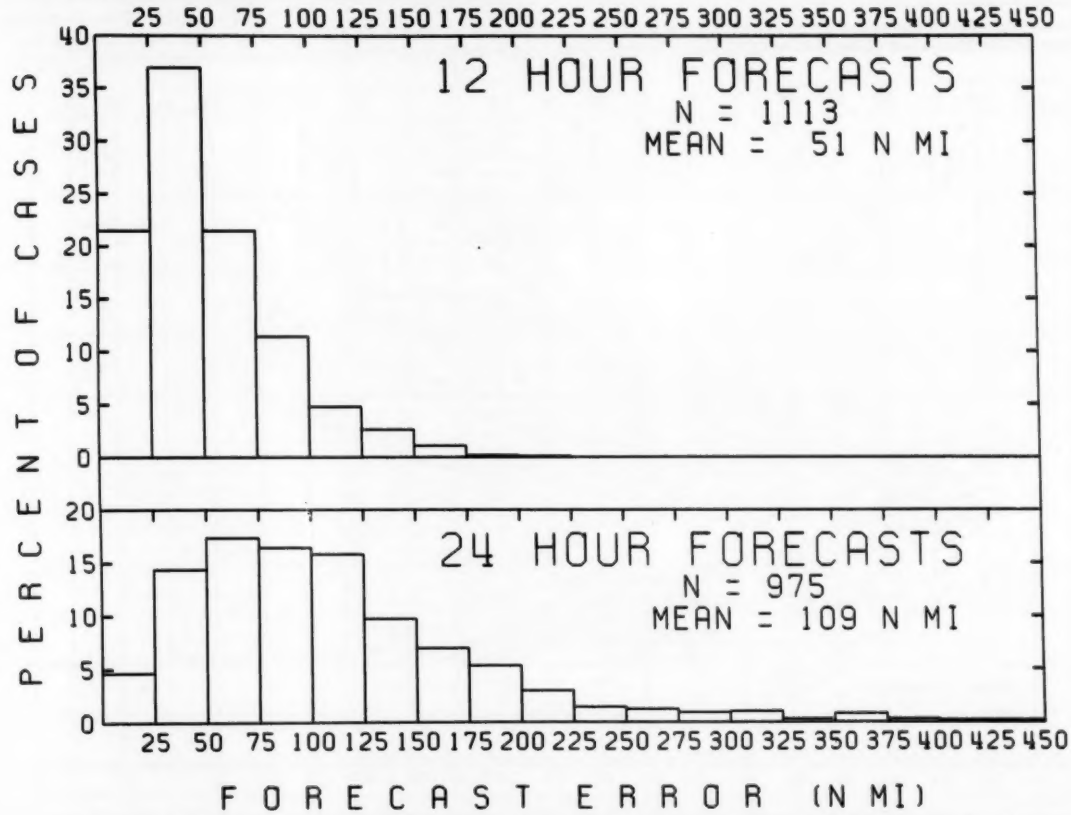

Figure 2.--Distribution of magnitude of forecast errors, 1970-1979. The quantity "N" is sample size.

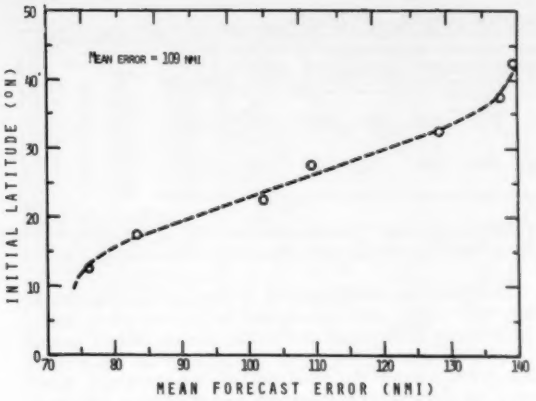

Figure 3.--Latitudinal variation in mean forecast error, 1970-1979.

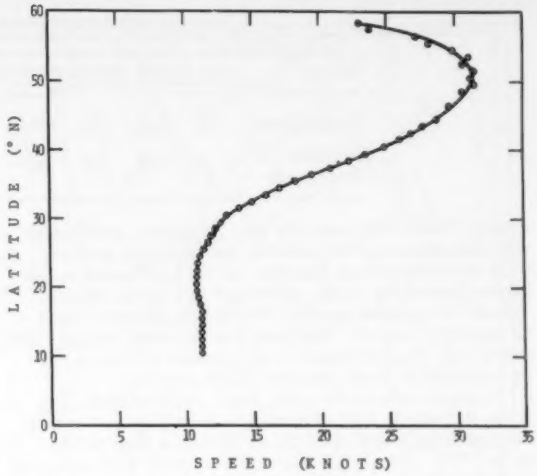

Figure 4.--Latitudinal variability in the translational speeds of Atlantic tropical cyclones. Computations are based on 782 storms, 1886-1979.

in the north zone had recurved into the westerlies or were in the process of doing so.

The difference in forecast error between storms in the south and those in the north zone reflects the fact that the former move slower, have a greater degree of motion steadiness (persistence) and adhere better to known climatological patterns than the latter. Most mariners are aware of the often erratic behavior and accelerations of middle and high latitude tropical cyclones.

Although there is a marked difference in mean forecast error between south zone and north zone storms, figure 3 shows that the 24-hr forecast errors gradually increase from south to north rather than suddenly increasing at 24.5°N. On the average, the lower the latitude of the storm, the lower will be the forecast error. Exceptions to the rule will be noted later.

One reason for the poleward increase in mean forecast error is a similar poleward increase (fig. 4) in the mean translational speed of tropical cyclones beginning about latitude 29°N, which is also the average latitude of tropical cyclone recurvature. Thus, storms embedded in the easterlies (south of 29°N) exhibit reasonably steady speeds regardless of latitude whereas those storms embedded in the westerlies (north of 29°N) typically accelerate as they move poleward, at least up to latitude 50°N. For a given error in the forecast direction of a tropical cyclone, the total forecast error is proportional to the speed at which the forecast and observed tracks diverge. At low latitudes, large forecast errors are typically not observed since the slower speeds and lack of acceleration preclude excessively large forecast errors even with erroneous directional forecasts.

At midlatitudes, directional forecasting becomes more difficult because of the interaction between easterly and westerly circulations. It is often difficult to predict if and when a storm, presently in the easterlies, will recurve into the westerlies. This is a particularly error-prone situation since the combination of direction and speed errors can lead to large total forecast errors. Most of the large errors depicted in figure 2 were of this type; that is, a forecast of recurvature which did not occur or recurvature which was not forecast. Often, forecasters correctly identify recurvature situations but incorrectly assess the timing.

Another factor besides forecast difficulty which affects forecast error is the availability of weather observations in and around the storm area. It can be shown (George and Gray, 1976) that a storm moves in accordance with the large-scale, deep-layer (surface to 40,000 ft) environmental flow patterns in which it is embedded. A knowledge of these patterns and how they are changing will allow for a reasonably good prediction of the storm's future course. A lack of this information requires that the forecast be based on other information such as climatology and past motion. As previously pointed out, such forecasts are reasonably good at low latitudes where storms tend to adhere to climatological pattern and persistence of motion. However, in middle and high latitudes where steering forces are highly variable in time and space, poor forecasts can result.

There are numerous other factors which relate to forecast error but to a lesser degree than the two factors just discussed. These include the ability to initially locate the storm center, which in turn depends somewhat on the intensity of the storm; more intense storms present a more definitive satellite image pattern. Also, multiple storms can interact in an often unpredictable way or compete for available forecaster or reconnaissance resources. Obviously, forecaster expertise also plays a role.

In summary, 12- and 24-hr forecast errors through the decade of the 1970's were mainly dependent on two factors: forecast difficulty and knowledge of environmental steering forces. The interaction between these two factors produces an error pattern that is highly dependent on latitude but which shows other reggional differences as well. These differences are discussed later.

INTERANNUAL VARIATION IN FORECAST ERROR

As pointed out earlier, the average 24-hr forecast

Table 1.--Average 24-hr forecast errors, 1970-1979

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Total 1970-79
Error (nmi)	81	103	133	108	90	114	127	128	135	84	109
Number of Forecasts	33	186	51	84	86	122	144	30	101	138	975

error, 1970-1979, was 109 mi. However, consistent with the concepts discussed in the previous section, wide variations from one year to the next would be expected depending on the character of a given season. Years with predominantly low-latitude storms would be expected to yield relatively low forecast errors, and years with predominantly mid-Atlantic storms would be expected to yield relatively high errors.

Forecast errors for each year, 1970 to 1979, are given in table 1; errors are seen to be highly variable, ranging from a low of 81 mi in 1970 to a high of 135 mi in 1978. Storm track charts for these 2 yr are presented as figures 5 and 6. In 1970 (fig. 5) it can be noted that regular season storms were, indeed, confined to the deep Tropics and the Gulf of Mexico, whereas in 1978, mid-Atlantic storms predominated.

Because these differences in forecast errors from one year to the next are caused by factors other than differences in forecast skill, the data in table 1 cannot be used to assess long-term changes in the state-of-the-art of Atlantic tropical cyclone forecasting. However, in the study by Neumann and Pelissier referred to in the first section, the authors have adjusted yearly errors according to forecast difficulty for that year, and it is shown that skill in Atlantic tropical cyclone forecasting, at least at the 24-hr projection, remained relatively unchanged over the decade of the 1970's.

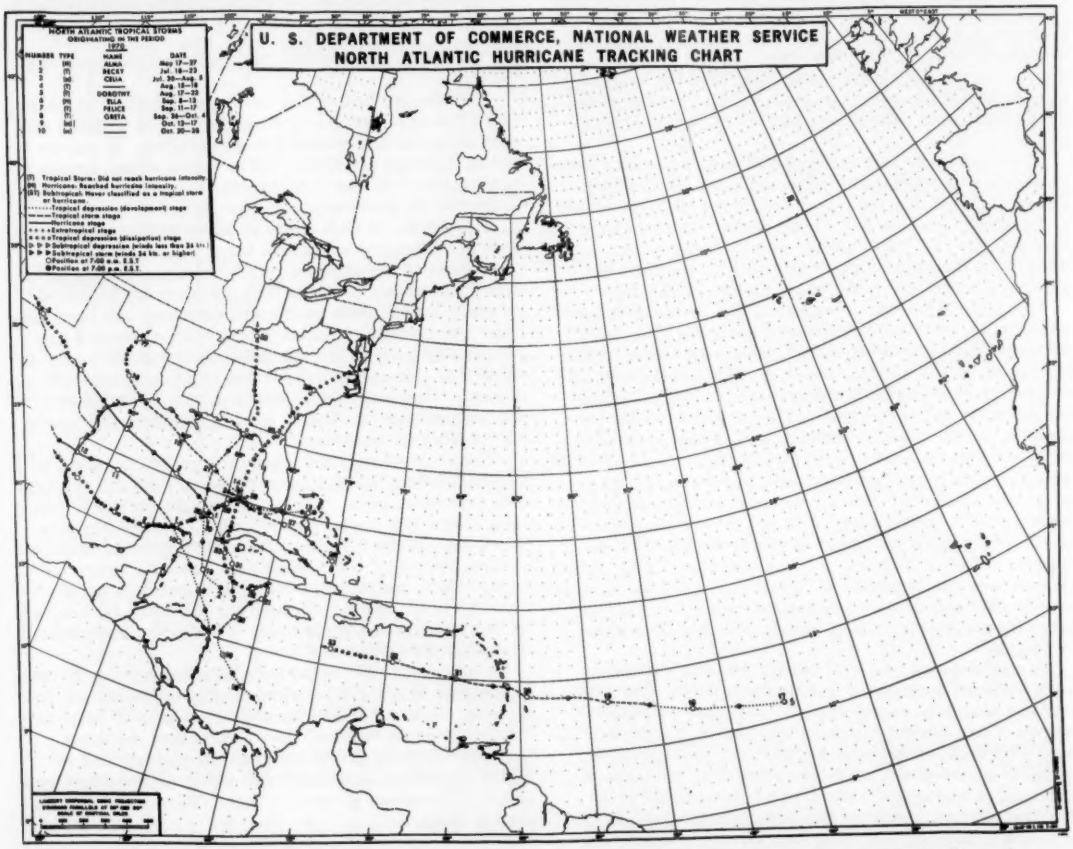

Figure 5.--Named Atlantic tropical cyclones, 1970. Three additional and unnamed storms (numbers 4, 9, and 10) which occurred in 1970 are not shown. Tracks of these are given by Neumann et al. (1978).

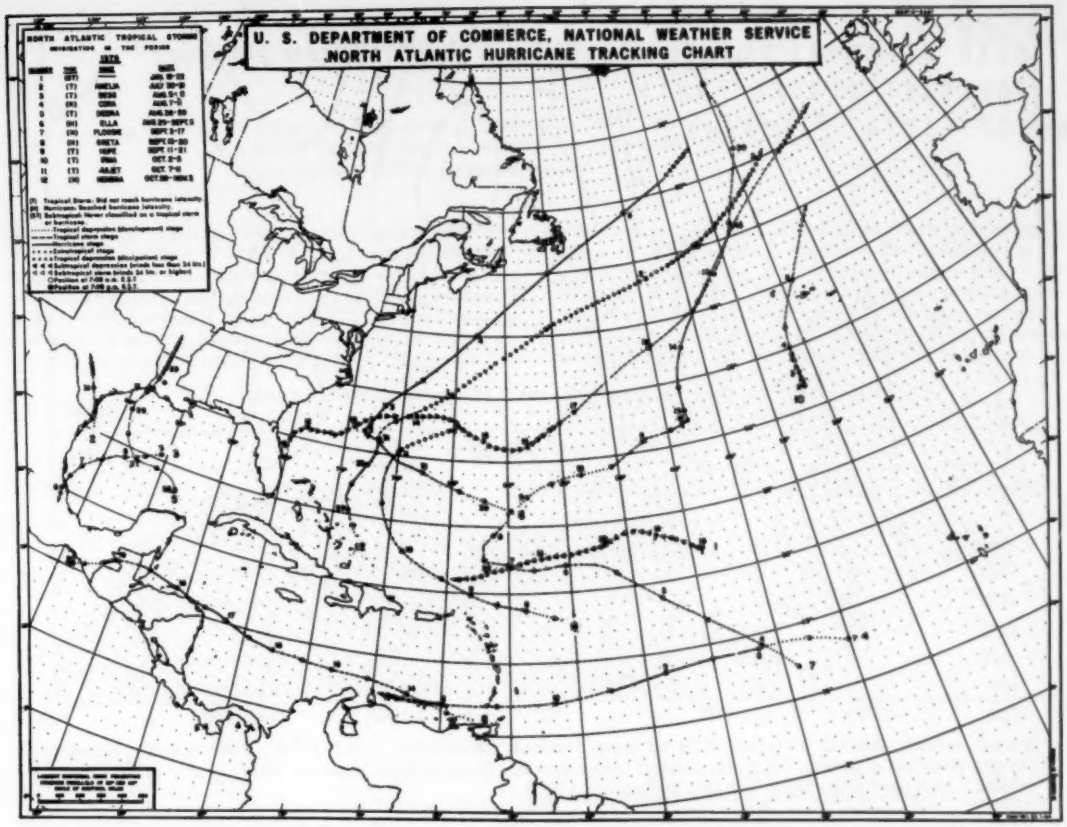

Figure 6.--Atlantic tropical cyclones, 1978.

REGIONAL DIFFERENCES IN FORECAST ERROR

The approximate increase in forecast difficulty from south to north together with the bulk of upper air observing stations being located over the western and southwestern portions of the Atlantic basin, as well as other circumstances, leads to a distribution of average 24-hr forecast error as depicted in figure 7. Here it can be noted that, although average overall error is 109 mi, regional errors averaged from a low of near 60 mi for storms initially located off South America near 60°W to more than 140 mi for those initially located 10 degrees of longitude east of the mid-Atlantic States.

The minimum off the coast of South America results from storm motion being extremely persistent at these latitudes and the presence of a reasonable number of reporting stations. The maximum off the east coast of the United States corresponds to an area where sudden storm accelerations northeastward are common and where there is a complete lack of rawinsonde stations which report upper air wind and pressures. Atlantic Ocean Station Vessels, which did have this capability over at least some portions of the Atlantic, were decommissioned beginning in 1973.

Other features of figure 7 are also significant. These include the minimum error over the northeastern Gulf of Mexico and the maximum north of Puerto Rico. The reason for the minimum over the Gulf is not fully understood but is certainly related to the fact that storm motion is quite persistent in this area and there is a large amount of observational data including continuous aircraft reconnaissance. This enables the forecaster to both accurately determine initial storm motion and to assess future environmental steering forces. The maximum error north of Puerto Rico corresponds to an area where forecasts of recurvature are uncertain.

The shaded area in figure 7 depicts the area where errors are below average. Here it can be noted that, with the exception of the extreme northwestern Gulf of Mexico, errors over the Gulf of Mexico and the Caribbean are similar in magnitude and, for the most part, are less than 100 mi in 24 hr. This is, indeed, fortunate, since most of the encounters of tropical cyclones with populated land areas are within this zone. However, over most of the North Atlantic, 24-hr tropical cyclone forecast errors typically exceed 120 mi.

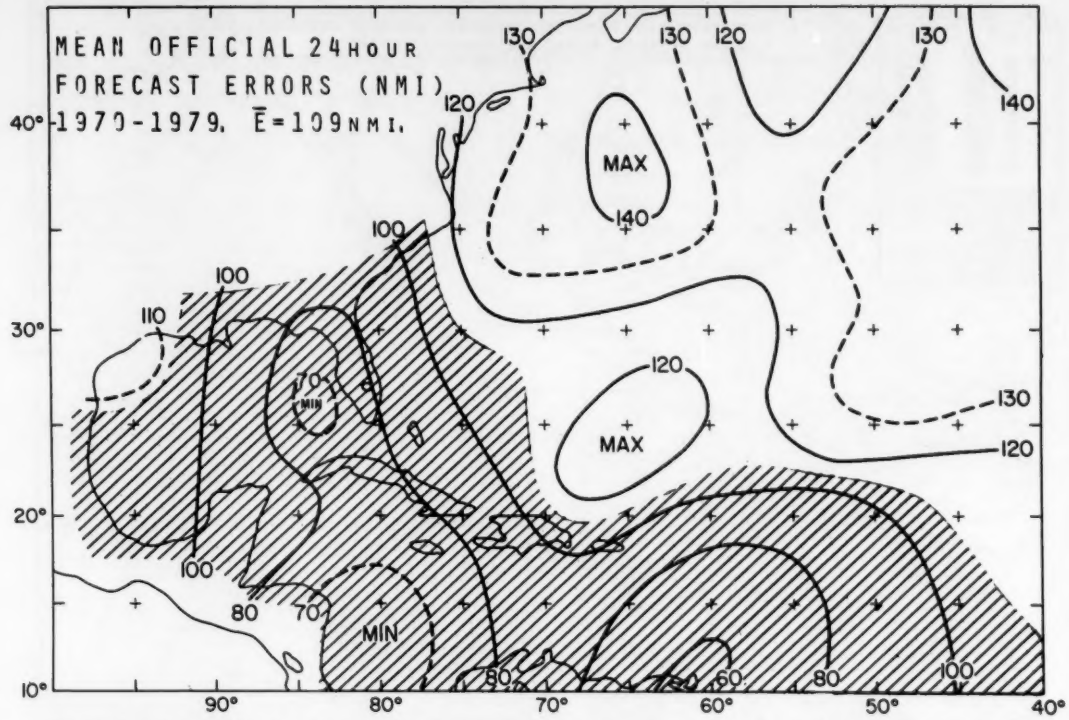

Figure 7.--Geographical variation of 24-hr mean forecast errors (mi), 1970-1979. Errors are relative to initial position of storm. $\bar{E}$ gives overall mean error. Shading depicts areas where error is below average. (Adapted from Neumann and Pelissier, 1981)

ADDITIONAL COMMENTS

In this study it has been shown that tropical cyclone forecast errors on the average are directly proportional to the initial latitude of a storm; that is, low-latitude storms tend to have low forecast error, and high-latitude storms tend to have high forecast error. However, a notable exception exists in the eastern Gulf of Mexico where forecast errors are less than one might expect for those latitudes. This condition reflects persistence of storm motion in this portion of the Gulf as well as a large amount of observational data. Mariner awareness of these error patterns should provide for a better interpretation of tropical cyclone advisories. Little significant changes in this pattern are expected during the decade of the 1980's.

Additional information on Atlantic tropical cyclone forecast errors over the decade of the 1970's can be found in Neumann and Pelissier, 1981. A similar study for the western Pacific is given by Jarrell et al. (1978).

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WESTERN NORTH PACIFIC TYPHOONS, 1980

Extracted from Annual Tropical Cyclone Report, 1980, U. S. Naval Oceanographic Command Center, Joint Typhoon Warning Center, Guam, Mariana Islands.

The western North Pacific experienced the second consecutive year of below-normal tropical cyclone activity during 1980 (table 2). Twenty-eight tropical cyclones occurred during both 1979 and 1980 compared to an average annual total of about 33 cyclones (tables 3 and 4). Four significant tropical cyclones failed to develop beyond the tropical depression (TD) stage, and nine tropical storms (TS) failed to reach typhoon intensity. Of the 15 tropical cyclones that developed to typhoon (TY) intensity, only 2 reached supertyphoon (ST) intensity of 130 kn. Tropical cyclones reaching tropical storm intensity or greater are assigned names in alphabetical order from a list of alternating male and female names. Each tropical cyclone's maximum sur-

Table 2.--Significant tropical cyclones, western North Pacific, 1980

CYCLONE	TYPE	NAME	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	MAX SFC WIND(KT)	MIN OBS SLP	NUMBER OF WARNINGS	DISTANCE TRAVELLED(NM)
01	TD	TD-01	20 MAR-24 MAR	5	30	1000	17	2439
02	TS	CARMEN	05 APR-08 APR	4	60	980	9	1179
03	TY	DOM	09 MAY-19 MAY	11	90	956	42	1938
04	TY	ELLEN	13 MAY-21 MAY	9	110	931	34	2423
05	TS	FORREST	20 MAY-26 MAY	7	55	990	26	2451
06	TS	GEORGIA	21 MAY-24 MAY	4	55	985	12	993
07	TS	HERBERT	24 JUN-28 JUN	5	50	980	15	2521
08	TS	IDA	06 JUL-11 JUL	6	60	980	23	1527
09	TY	JOE	17 JUL-23 JUL	7	105	940	25	2541
10	TD	TD-10	17 JUL-19 JUL	3	30	1000	7	1007
11	ST	KIM	20 JUL-27 JUL	8	130	908	29	2661
12	TY	LEX	29 JUL-07 AUG	10	80	962	36	1810
13	TY	MARGE	08 AUG-15 AUG	8	110	944	31	1980
14	TD	TD-14	15 AUG-16 AUG	2	20	1003	7	229
15	TY	NORRIS	24 AUG-28 AUG	5	90	950	20	1710
16	TD	TD-16	04 SEP-06 SEP	3	25	1002	8	776
17	TY	ORCHID	07 SEP-11 SEP	5	85	958	19	2043
18	TY	RUTH	14 SEP-16 SEP	3	65	975	13	60
19	TY	PERCY	14 SEP-19 SEP	6	125	919	20	1260
20	TY	SPERRY	15 SEP-20 SEP	6	65	987	22	2624
21	TS	THELMA	26 SEP-30 SEP	5	55	982	16	1681
22	TY	VERNON	27 SEP-03 OCT	7	105	935	25	2141
23	ST	WYNNE	04 OCT-14 OCT	11	150	890	44	3728
24	TS	ALEX	12 OCT-14 OCT	3	35	999	8	1044
25	TY	BETTY	29 OCT-07 NOV	10	120	928	39	3228
26	TS	CARY	29 OCT-01 NOV	4	40	998	14	1068
27	TY	DINAH	21 NOV-25 NOV	5	100	941	17	3530
28	TS	ED	16 DEC-21DEC	6	50	988	20	815
			1980 TOTALS	128*			598	

* OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM.

Table 3.--Frequency of typhoons by month and year

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Average (1945-58)	0.4	0.1	0.3	0.4	0.7	1.1	2.0	2.9	3.2	2.4	2.0	0.9	16.3
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
1968	0	0	0	1	1	1	1	4	3	5	4	0	20
1969	1	0	0	1	0	0	2	3	2	3	1	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	3	1	2	6	3	5	3	1	0	24
1972	1	0	0	0	1	1	4	4	3	4	2	2	22
1973	0	0	0	0	0	0	4	2	2	4	0	0	12
1974	0	0	0	0	1	2	1	2	3	4	2	0	14
1975	1	0	0	0	0	0	1	3	4	3	2	0	15
1976	1	0	0	1	2	2	2	1	4	1	1	0	15
1977	0	0	0	0	0	0	3	0	2	3	2	1	11
1978	0	0	0	1	0	0	3	2	4	3	2	0	15
1979	1	0	1	1	0	0	2	2	2	2	1	1	13
1980	0	0	0	0	2	0	3	2	5	2	1	0	15
Average (1959-80)	0.25	0.05	0.13	0.70	0.85	0.90	2.80	3.30	3.25	3.10	1.60	0.55	17.6

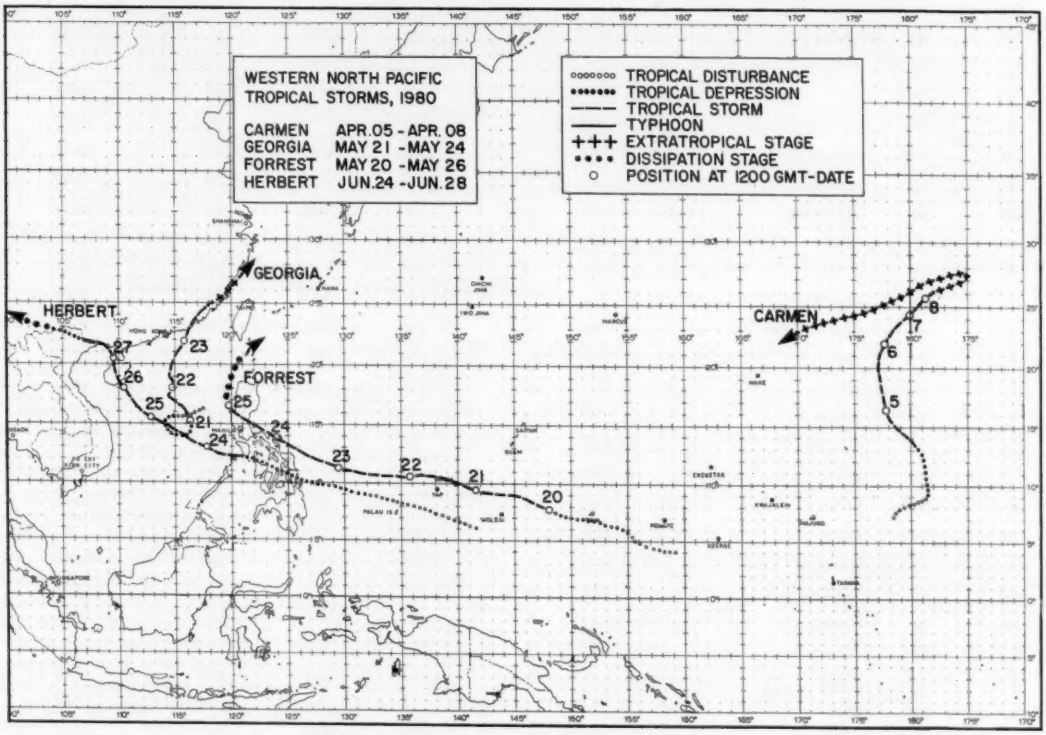


Figure 8.--Tropical storm tracks, 1980.

face winds (kn) and minimum observed sea-level pressure (mb) were obtained from best estimates based on all available data. The distance traveled (mi) was calculated from the Joint Typhoon Warning Center's (JTWC) official best track.

The number of warning days decreased from 149 in 1979 to 128 in 1980. There were 37 days with two cyclones and 3 days with three or more cyclones.

The cyclone tracks are shown in figures 8, 9, 10, 11, and 12. The tracks are shown from first detec-

Table 4.--Frequency of tropical storms and typhoons by month and year

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Average (1945-58)	0.4	0.1	0.4	0.5	0.8	1.3	3.0	3.9	4.1	3.3	2.7	1.1	21.6
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	3	5	3	2	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	2	2	7	9	7	6	6	1	40
1965	2	2	1	1	2	3	5	6	7	2	2	1	34
1966	0	0	0	1	2	1	5	8	7	3	2	1	30
1967	1	0	2	1	1	1	6	8	7	4	3	1	35
1968	0	0	0	1	1	1	3	8	3	6	4	0	27
1969	1	0	1	1	0	0	3	4	3	3	2	1	19
1970	0	1	0	0	0	2	2	6	4	5	4	0	24
1971	1	0	1	3	4	2	8	4	6	4	2	0	35
1972	1	0	0	0	1	3	6	5	4	5	2	3	30
1973	0	0	0	0	0	0	7	5	2	4	3	0	21
1974	1	0	1	1	1	4	4	5	5	4	4	2	32
1975	1	0	0	0	0	0	2	4	5	5	3	0	20
1976	1	1	0	2	2	2	4	4	5	1	1	2	25
1977	0	0	1	0	0	1	4	1	5	4	2	1	19
1978	1	0	0	1	0	3	4	7	5	4	3	0	28
1979	1	0	1	1	1	0	4	2	6	3	2	2	23
1980	0	0	0	1	4	1	4	2	6	4	1	1	24
Average (1959-80)	0.55	0.35	0.45	0.85	1.27	1.55	4.50	5.35	5.00	4.15	2.30	1.15	27.5

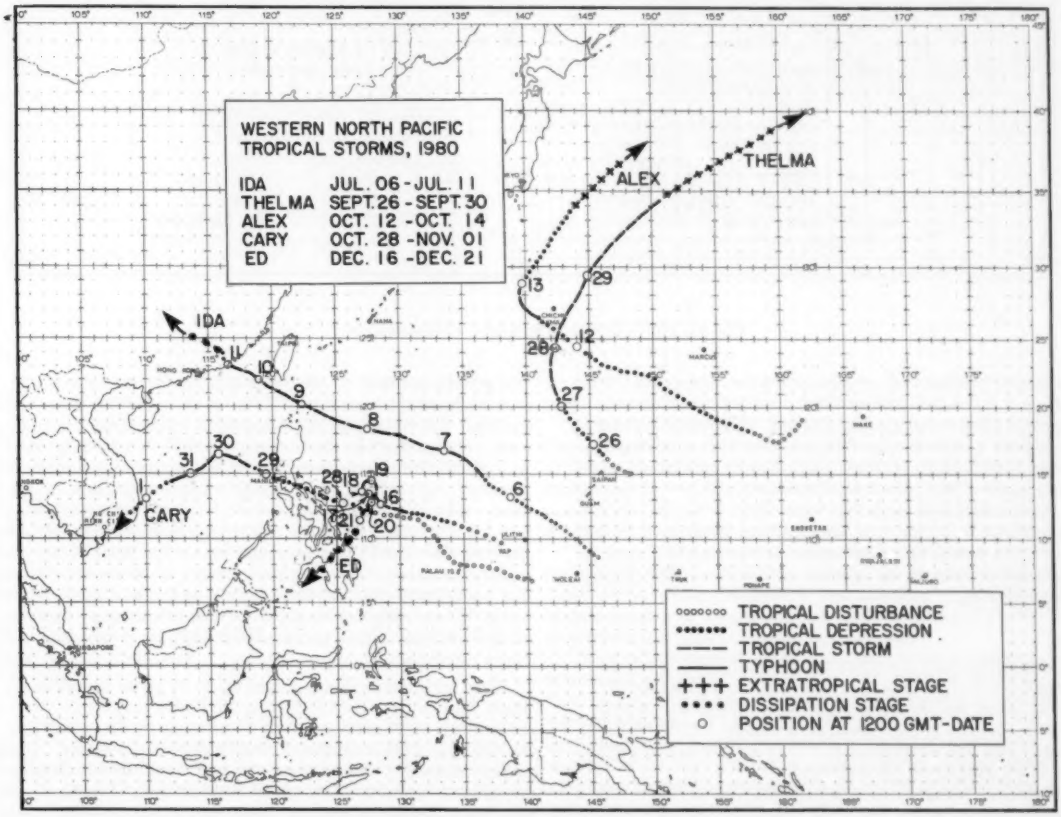


Figure 9.--Tropical storm tracks, 1980.

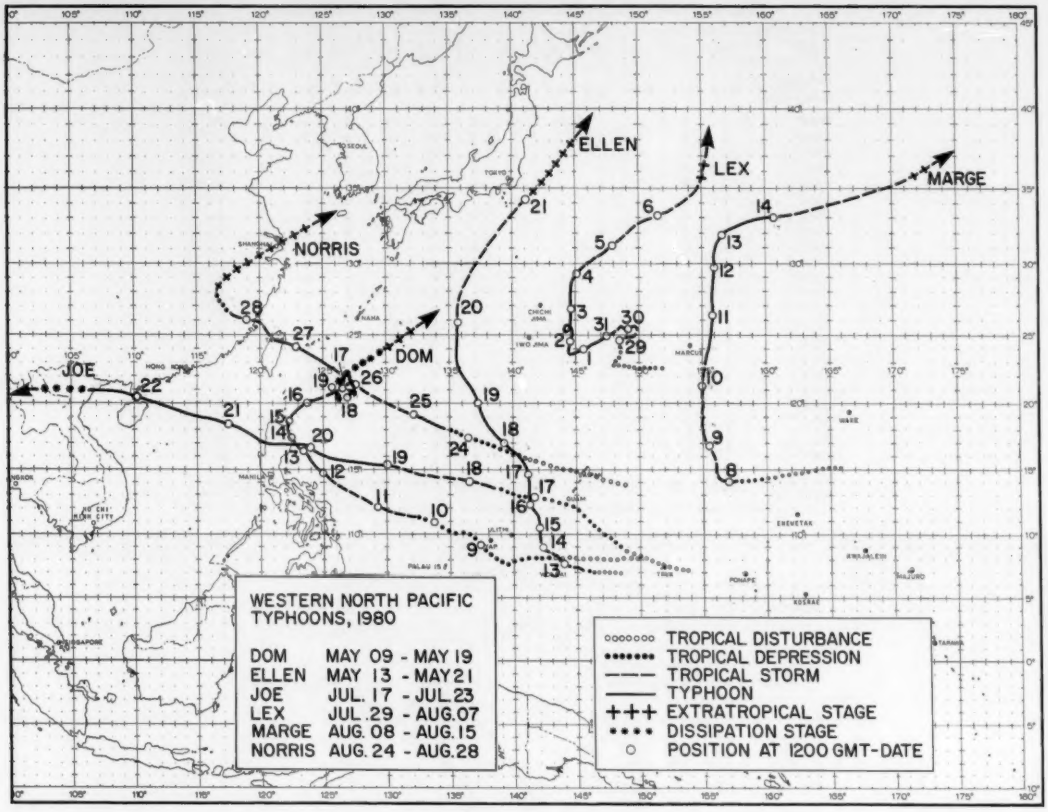


Figure 10.--Typhoon tracks, 1980.

tion until dissipation or becoming extratropical. In tables 3 and 4 the storms are credited in the month that the first warning was issued. Numbers in some past year's tables may disagree, as those tables indicated month of first detection. Maximum winds are estimates of sustained windspeeds for a 1-min average.

Individual typhoons are described in the following narratives. Times are GMT unless otherwise indicated. The tropical storm summaries may be found in the Smooth Log of the appropriate issue of the Mariners Weather Log.

TYPHOON DOM

Dom was the first tropical cyclone that developed to typhoon intensity in the western North Pacific in 1980. Dom had several features of interest: a pronounced tilt in the vertical axis during the developing stages and the execution of a rare anticyclonic loop in the later stages of his existence.

Satellite imagery showed a weak disturbance which first appeared along the near equatorial trough on May 5. The disturbance showed no significant development as it tracked across the Caroline Islands during the following 3 days. By the 9th satellite imagery indicated strong outflow on the west side of the circulation and increased organization of convective cloud elements. Little change in intensity occurred during the next 2 days, during which time the 700-mb circulation was displaced as much as 77 mi west-southwest of the surface center. Vertical shear remained strong as Dom moved westward, steered by strong mid- to upper level easterlies along the southern periphery of the mid-level subtropical ridge axis. On May 10 a midtropospheric low-pressure center developed over the Asia Mainland, causing the ridge to recede eastward. Dom reached tropical-storm intensity at 1800 on the 10th as an anticyclone with outflow in all quadrants developed at upper levels.

Dom attained typhoon intensity at 0600 on the 12th. When Dom intensified to 90 kn, he had a large eye 30 mi in diameter and his speed of movement decreased markedly. Dom became virtually stationary as he drifted slowly toward Luzon and weakened due to the decreased moisture content of the air being drawn into his circulation across the mountainous terrain of Luzon. By 1200 on the 14th Dom had weakened to tropical-storm intensity and was showing indications of impending recurvature.

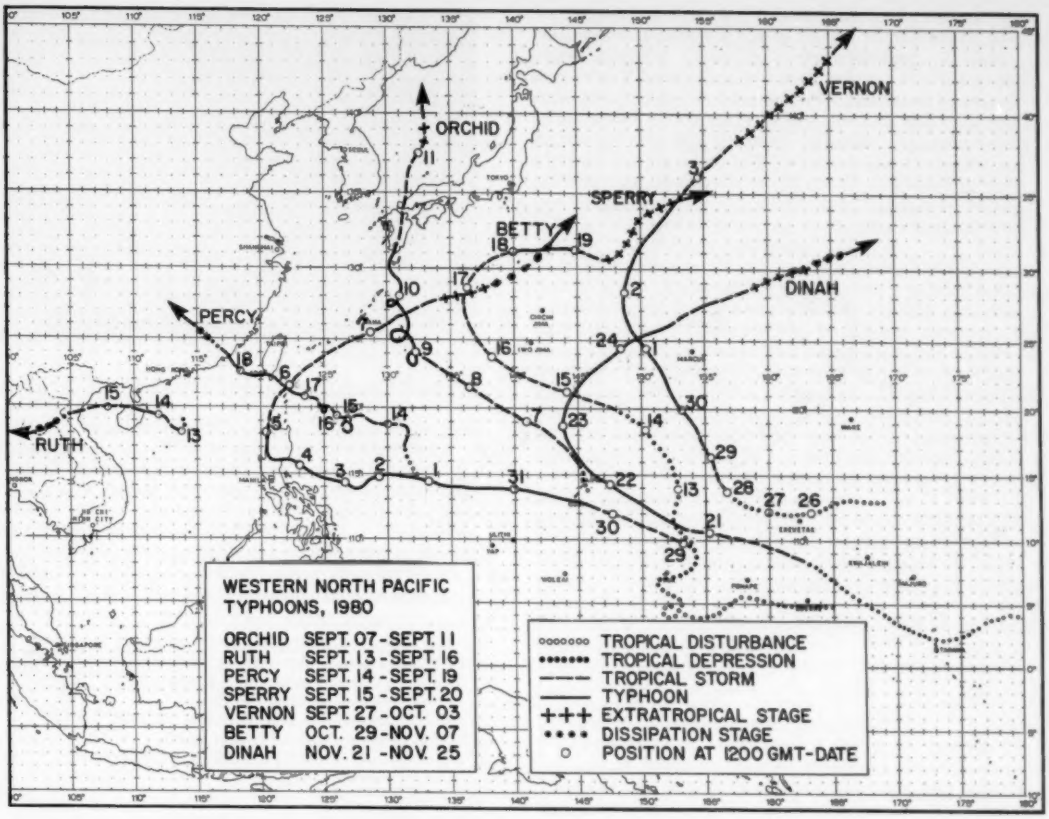


Figure 11.--Typhoon tracks, 1980.

Dom unexpectedly regained typhoon strength 24 hr after recurvature. Reintensification was made possible by a lessening of the land effect and energy provided by a tongue of warm water extending north of Luzon. Dom then tracked northeastward south of the area of maximum sea surface temperature. He finally decreased to tropical storm intensity due to the shearing effect of strong upper tropospheric westerlies and strong low-level easterlies. The upper level center continued to track eastward, whereas the surface circulation began a rare anticyclonic loop as it tracked westward under the influence of the low-level easterly flow. At 0000 on the 19th, JTWC issued the final warning on Dom.

TYPHOON ELLEN

Typhoon Ellen developed in an active, near-equatorial trough west of the Truk Islands on May 11. The initial tropical disturbance became evident on satellite imagery between 1200 on the 11th and 0000 on the 12th. Between 1200 and 1600 on the 12th Ellen's satellite signature improved markedly. Aircraft reconnaissance at 0422 on the 13th confirmed Ellen's rapid development with maximum surface winds estimated at 45 to 50 kn. The first warning was issued at 0600 on the 13th. Postanalysis indicates that Ellen reached tropical-storm strength at 1800 on the 12th.

Ellen appeared to be following Dom's track across the Philippine Sea, but on the 15th she abruptly turned to the north and was headed for Japan. Ellen tracked north-northwestward and intensified to 65 kn. She passed 220 mi west of Guam at 0000 on the 17th with maximum sustained surface winds of 110 kn (fig. 13).

Typhoon Ellen's surface circulation followed a pronounced oscillatory motion about a basic north-northwest track. The short-term oscillations were difficult to interpret and thus made forecasting Ellen's movement very difficult.

During this period Ellen deepened to her lowest minimum sea-level pressure of 931 mb and intensified an additional 45 kn, reaching her maximum intensity of 110 kn. Ellen recurved between 25° and 30°N and accelerated northeastward at forward speeds in excess of 30 kn. Following recurvature, Ellen weakened rapidly and merged with an extratropical low-pressure system south of Honshu.

Ellen passed closer to Japan than originally forecast due to rapid deepening of a midlatitude trough over Japan and rapid intensification of the subtropical ridge east of Japan. Flooding reported in Kyushu and

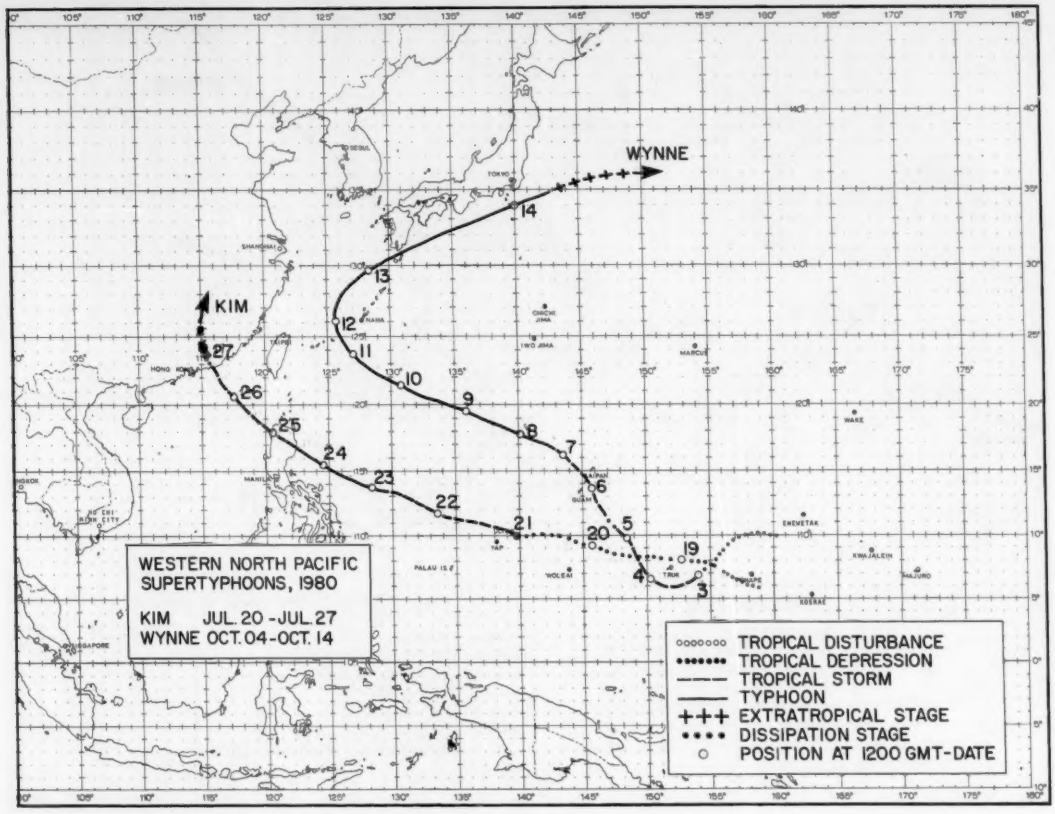


Figure 12.--Supertyphoon tracks, 1980.

Figure 13.--Typhoon Ellen shortly after reaching typhoon intensity at 0054 May 15, 1980. DMSP Imagery.

Shikoku resulted from heavy rain produced by the extratropical low-pressure system which eventually merged with Ellen south of Honshu.

TYPHOON JOE

Typhoon Joe, the ninth tropical cyclone in the western Pacific region, proved to be very predictable. Joe's genesis from a tropical disturbance into a mature tropical cyclone was slow. Satellite imagery first indicated a disturbance along the equatorial trough on July 14 over the Caroline Islands. On the 16th aircraft reconnaissance found a weak surface circulation which did not extend up to the 700-mb level. At that time the minimum sea-level pressure was 1006 mb. Defense Meteorological Satellite Program (DMSP) imagery on the 17th suggested that the disturbance was developing a circulation center that extended at least to midtropospheric levels. Aircraft reconnaissance substantiated that the disturbance had indeed developed significantly since the 16th and that the circulation center had extended up to the 700-mb level. The depression was upgraded to tropical storm Joe on the 18th, and typhoon strength was attained on the 19th (fig. 14).

Joe tracked along a nearly straight course through much of his existence. His forward speed of move-

Figure 14.--Typhoon Joe approaches Luzon on the 19th.

ment was rapid and nearly constant, even while passing over Luzon. This unusually persistent track and high speed of movement was correlated with an abnormally strong mid- and upper tropospheric subtropical ridge. Six hours prior to landfall over Luzon Joe attained an intensity of 105 kn with a minimum sea-level pressure of 940 mb at 1200 on July 20. Joe weakened rapidly to tropical-storm strength while crossing Luzon, but still remained very destructive.

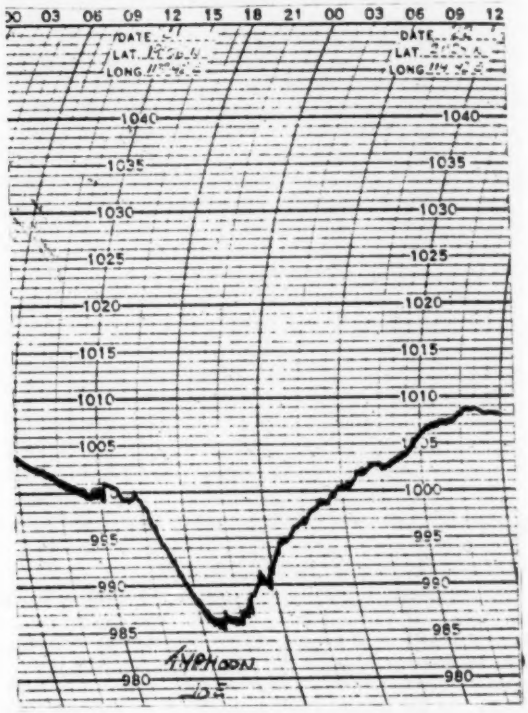


Figure 15.--SAMOA's barogram hits 985 mb in its encounter with typhoon Joe.

As he tracked across the mountainous terrain of Luzon, where peaks approach 10,000 ft, the track deviated slightly, becoming more westward. It took just over 6 hr for Joe to cross Luzon, but in that short time the Philippine Islands were inundated by heavy rains which produced massive flooding and resulted in extensive crop and property damage. Approximately 177,000 people were left homeless and 19 deaths reported. Exact figures could not be compiled in time due to typhoon Kim, which hit the Philippines within a week of Joe, compounding destruction that the Philippines had already suffered.

Upon entry into the South China Sea, Joe reintensified to typhoon strength. He attained a second maximum intensity of 90 kn as determined by Dvorak analysis of satellite data. At the time of maximum intensity, the radius of winds greater than 30 kn extended 450 mi to the east of Joe's center, covering most of the South China Sea north of 10°N. The LNG CAPRICORN found 51-kn winds and 13-ft seas in the Luzon Strait. The SAMDA encountered 58-kn winds and a minimum pressure of 986 mb (fig. 15) 150 mi from the eye, and the APOLLO PEAK, about 40 mi from the center reported 57-kn winds and 973-mb pressure. The JUPITER II dragged anchors and crashed into a sea wall at Manila.

While transiting across the South China Sea, Joe devastated the coastal regions which paralleled his track. Damage to crops and property occurred in southern China due to flooding caused by torrential rains. Joe also left many homeless and claimed more lives while tracking toward Vietnam.

SUPERTYPHOON KIM

Supertyphoon Kim, one of the most intense typhoons of the 1980 season, slammed onto the eastern coast of Luzon 4 days after typhoon Joe had practically immobilized the area. Accounts of the aftermath of typhoon Kim estimated that 15 people were killed and 167,000 residents of the Philippines were displaced. Torrential rains caused massive flooding over Luzon as far south as Manila.

Kim was first detected on satellite imagery on July 19. The disturbance appeared as an area of enhanced convection embedded in the near-equatorial trough. Further intensification appeared likely as the tropical upper-tropospheric trough was positioned to the northwest of the convective area. Aircraft reconnaissance data indicated a well-defined, closed surface circulation with windspeeds of 25 to 30 kn and a central pressure of 1001 mb approximately 360 mi southeast of Guam.

At 1200 on the 21st the tropical depression passed directly over Ulithi, which reported a wind maximum of 35 kn. This information, plus a subsequent aircraft report of a central surface pressure of 997 mb, prompted JTWC to upgrade the depression to tropical storm Kim at 1800. Further intensification was slow during the 22d and 23d. Kim was following a path similar to that of typhoon Joe across the Philippine Sea. On the 23d aircraft reconnaissance observed a fairly substantial drop in surface pressure to 979 mb and indications that an eyewall was partially forming. Kim was upgraded to a typhoon.

On the 24th a minimum sea-level pressure of 908 mb was measured by dropsonde. This pressure was

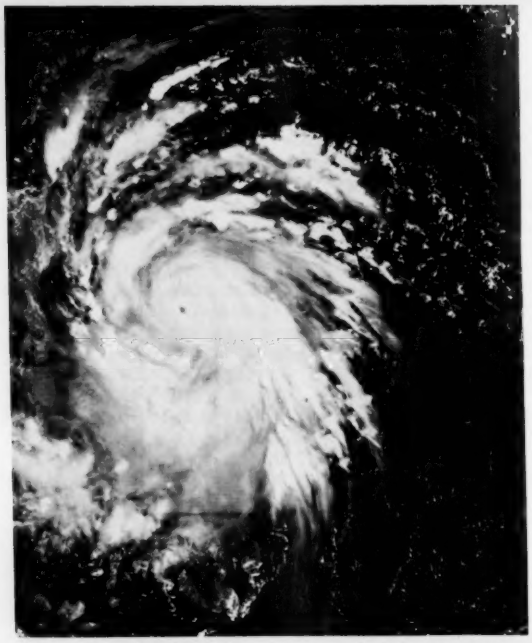


Figure 16.--Typhoon Kim at approximately 110-kn intensity before she reached supertyphoon strength at 0125 July 24, 1980. DMSP Imagery.

sufficiently low to qualify Kim as a supertyphoon (fig. 16). Early on the 25th Kim moved onto the coast of Luzon with maximum sustained winds of 100 kn and reported wind gusts as high as 125 kn.

Terrain weakened Kim as she moved slowly across Luzon before emerging in the South China Sea as an ill-defined tropical storm. JTWC forecasters expected Kim to reintensify as a typhoon over the South China Sea similar to Joe. Aircraft reconnaissance, however, continued to report that Kim lacked significant organization and that her associated convective tops were significantly lower than previously observed. The JAPAN IRIS reported 58-kn winds about 80 mi from the center.

A weakness in the midtropospheric ridge allowed Kim to track more northwest towards Hong Kong, and she finally made landfall on the coast of China 90 mi northeast of Hong Kong at 0600 on the 27th. Maximum sustained winds of 45 kn and winds gusts to 60 kn were reported as Kim moved inland.

TYPHOON LEX

Typhoon Lex was the most difficult tropical cyclone to forecast during the 1980 season. This typhoon developed from a Tropical Upper Tropospheric Trough near 22°N, 152°E, and initially moved westward. From this point, Lex made five right-angle or greater turns and executed one tight cyclonic loop before finally heading northeastward into the western Pacific east of Japan. The only saving grace was that Lex remained well away from major landmasses.

Lex was first observed as a small disturbed area of convection on July 24. The first warning was issued at 0600 on the 29th after aircraft reconnaissance located a surface circulation center with a central pressure of 1002 mb and estimated maximum surface winds of 35 kn. Twelve hours later, as the satellite signature continued to improve, the cyclone was upgraded to tropical storm Lex.

During the early development stage, a deep steering current was not evident above Lex. However, a broad 200-mb trough to the north-northeast seemed to have the strongest influence and turned Lex from a westward to a northeastward track. As the upper trough moved eastward, a middle- and upper-level ridge built to the northwest of Lex. The steering currents veered from southwesterly to northeasterly in response to the intensifying subtropical ridge, and Lex turned southwestward.

Lex continued to intensify slowly during his southwestward movement, reaching typhoon strength of 65 kn at 0600 on the 31st. On August 2 Lex again changed direction and headed northward through a break in the subtropical ridge. The break had developed as a trough deepened to the north over the Sea of Japan. The DAMPIER MARU was sailing northward and closing with the storm with 20-ft swells from the 1st to the 3d.

Figure 17.--Typhoon Lex at maximum intensity of 80 kn at 2242 on August 2. Iwo Jima is about 155 mi west of Lex. NOAA-6 Imagery.

Lex executed a cyclonic loop while accelerating northward and, before completing the loop, reached maximum intensity of 80 kn (fig. 17). Upon exiting the loop, Lex continued tracking north until a deep surface low and associated cold front began moving eastward across Japan. As the frontal system approached from the west, Lex curved to the northeast. The slow entrainment of cold air caused Lex to weaken and transition into an extropical system. The ATLANTIC PIONEER found 54-kn

winds and 20-ft waves on the 5th while 360 mi east of the storm's center.

TYPHOON MARGE

Marge, the sixth tropical cyclone to reach typhoon strength during 1980, developed west of the Marshall Islands. Convective activity appeared to consolidate near 15°N, 159°E, by August 6. The convective area expanded and by the 7th covered an area nearly 5-degrees square.

The first reconnaissance into Marge on the 8th observed surface winds of 35 kn and a central pressure of 998 mb. Based on these data, the initial warning on tropical storm Marge was issued at 0800. At first Marge followed a generally west-southwestward track. The 500-mb streamline analysis indicated that Marge was located in a col, thus providing a channel for a more northerly track than predicted by climatology. A satellite position fix, combined with aircraft fixes, confirmed the northward track on the 9th.

Marge tracked northward for 17 degrees of latitude between two centers in the subtropical ridge. During the northward trek, Marge intensified to typhoon strength, which she maintained for nearly 5 days. A minimum sea-level pressure of 944 mb supported a maximum intensity of 110 kn for 18 hr (fig. 18).

Figure 18.--Visual satellite imagery of typhoon Marge at maximum intensity and minimum sea-level pressure at 2124 on August 10. NOAA-6 Imagery.

By the 13th Marge began to encounter strong upper level westerlies. A second course change accompanied by gradual acceleration and weakening began at that time. The final warning on Marge was issued on the 15th as she transitioned into an extratropical cyclone and merged with a midlatitude low-pressure system. The remnants of Marge treated the SEA-LAND PATRIOT to 44-kn winds and 20-ft seas.

TYPHOON NORRIS

An upper level anticyclone formed over a surface disturbance, and, as the disturbance continued to organize, a Tropical Cyclone Formation Alert was issued on August 23. Norris tracked virtually straight west-northwestward at an average speed of 12 kn from the time of the first warning as a tropical depression on the 24th until landfall on northern Taiwan on the 27th. This straight track was due to the strong mid-level subtropical ridge which extended along 27°N from southern China eastward to the International Dateline during the latter part of August.

A circulation near the Philippine Islands prevented Norris from developing and intensifying more rapidly. When the other circulation finally went ashore over Luzon and dissipated, all the low-level inflow now was available and Norris intensified quickly from 50 kn and 985 mb at 0000 on the 26th to a peak of 90 kn and 950 mb about 36 hr later.

The well-established midlevel ridge north of Norris, with a strong high-pressure cell between Taiwan and Okinawa, was responsible for the climatological west-northwestward track with Norris skirting the northern tip of Taiwan.

Figure 19.--Typhoon Norris 20 mi southeast of Yonagunijima and 95 mi southeast of Taipei near peak intensity of 90 kn at 1051 on August 27.

Norris passed 10 mi southwest of Yonagunijima at 1200 on the 27th. At that time the island reported southeast winds of 80 kn and a sea-level pressure of 952.2 mb (fig. 19). Norris then turned more westward toward northern Taiwan. Excellent radar coverage from the island stations of Ishigakijima and Miyakojima and from Hua-Lien on Taiwan permitted JTWC

Figure 20.--Typhoon Norris as seen by radar at Hua-Lien at 0800 on August 27. Photo courtesy of Central Weather Bureau, Taipei, Taiwan.

to follow Norris as he tracked across Taiwan and into the Formosa Strait just north of Hsin-Chu. Surface winds of 39 kn with gusts to 64 kn on northern Taiwan were reported by Taipei at 1600 on the 27th (fig. 20).

Norris' track across Taiwan, change in speed, and observed weakening were classic examples of the effects of Taiwan on tropical cyclones. The mountainous terrain of Taiwan apparently produced an induced surface low on the lee side of the mountain range, causing the marked increase in speed and the westward bend in Norris' track.

Landfall just south of Fu-Chou on mainland China occurred about 0900 on the 28th and, although penetrating deeper inland than forecast, Norris eventually recurved northeastward. The remnants linked with a frontal system that moved out over the Yellow Sea and Sea of Japan.

TYPHOON ORCHID

On September 6 satellite imagery indicated that a tropical cyclone formation alert was required for a rapidly developing disturbance just north of Guam. A reconnaissance aircraft investigated the disturbance but was unable to close a surface circulation. Synoptic data indicated that gale-force winds existed in the eastern semicircle of the disturbance. The first warning for tropical storm Orchid was issued at 0200 on the 7th. Aircraft reconnaissance had observed 45-kn surface winds in the northeast quadrant of the storm but only 10- to 15-kn northwest winds in the western quadrant, indicating that a closed surface circulation had existed only for 6 to 12 hr before the first warning.

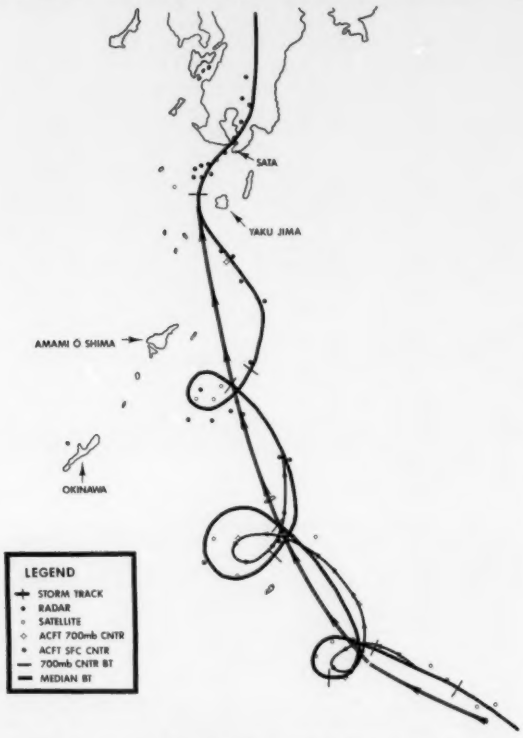


Figure 21.--An expanded best track from 0600 on the 9th to 0000 on the 11th. The figure shows the distribution of fix positions, a partial 700-mb track, and an overall smoothed track.

By the 9th Orchid had moved north into the subtropical latitudes near 23°N. Beginning at 0600 Orchid executed three high-speed cyclonic loops while maintaining an overall forward speed of 14 kn toward the north. Satellite, aircraft, and radar surveillance provided dense reconnaissance coverage of Orchid during these loops. Orchid finally stabilized on her northward track just prior to landfall on Kyushu, Japan. Figure 21 illustrates an expanded surface best track, a partial 700-mb track based on aircraft data, and the overall smoothed track, which may have been followed by Orchid at some level above 700 mb. An analogy which may offer some insight into Orchid's unexplained motion is given next.

Before offering the analogy, some conjecture is required based on the assumption that Orchid's circulation pattern relative to the broad-scale circulation was conditionally unstable; i.e., all the forces acting on Orchid were only in balance as long as she maintained a constant heading. As Orchid approached the mid-latitude trough, this balance was interrupted and the potential unstable character of the cyclone, embedded in this particular synoptic pattern, was realized. One

analogy that can be used to explain the trajectory involves a child's toy top. The top, inherently unstable because of its small base and wide body, will spin uniformly about its axis as long as it maintains equilibrium. A loss of rotational speed or a tap along the side will cause the top to stumble and the base will appear to accelerate along a predictable looping pattern until the top's stability is either restored or it comes to rest.

It is suggested that the effect was virtually the same when Orchid began interacting with the midlatitude trough. The best track shows that Orchid regained her equilibrium within the midlatitude trough prior to making landfall in southern Japan.

In an area of heavy shipping, Orchid was causing problems. The OCEAN CONTAINER, under tow by the tug SALVADORE, broke her towline in the rough seas of Orchid just east of Shikoku, off Cape Shio. The BEAURIVAGE, laden with more than 240,000 tons of crude oil, touched bottom while standing off the coast of Japan during Orchid. She sustained minor damage.

The most tragic account was that of the DERBYSHIRE, which last reported on the 9th that she was holding due to heavy seas and the approach of typhoon Orchid. Later the typhoon passed right over this last-reported position. All but one of the DERBYSHIRE's 42 crewmembers were British; two officers' wives were also on board. The ship was enroute for Kawasaki with a cargo of 158,000 tons of iron ore concentrates from Seven Island, Canada. This is one of the biggest losses under the British flag.

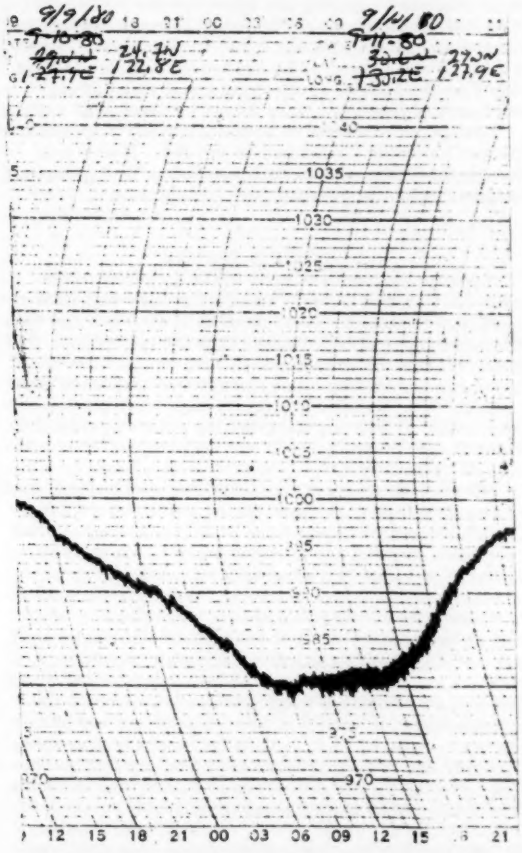


Figure 22.--SEA-LAND TRADE's encounter with Orchid on the 9th and 10th. The barogram trace indicates pressures below 985 mb for about 15 hr with a minimum of 978 mb at 0900.

By the 10th maximum winds in Orchid had climbed to 80 kn as she made her way up the Ryukyus towards Kyushu. Even in port ships were having their problems. The SEA HAWK and HE TIAN collided while anchored at Mutsure, sinking the SEA HAWK. The master died, but all other crewmembers were rescued. The collision was caused by the HE TIAN apparently swinging in Orchid's gusty winds. The RYOJIN off Toba, the entrance to Ise Bay, dragged her anchor in rough seas and rammed the HYUNDAI, causing minor damage to both ships. Among the many ship reports the following had waves of 25 to 33 ft: CARDIGAN BAY, MITSUTAMA MARU, SEA-LAND TRADE, and TAKAYAMA MARU. The AMSTELMOLEN had 39-ft swells, the BARBER PERSEAS had 52-kn winds and 52-ft swells, and the NEDLLOYD STEENKERK battled 60-kn winds and 59-ft swells. The SEA-LAND TRADE had winds near or over 50 kn from 0000 on the 10th until 0600 on the 11th. The highest was 68 kn at 1200 on the 10th near 29°N, 128°E, with a minimum sea-level pressure of 979 mb (fig. 22).

Orchid moved acsoss Kyushu on the 11th and dropped to tropical-storm strength as she moved through the Sea of Japan. The storm resulted in six deaths. Torrential rains fell over Kyushu, Shikoku, and western Honshu; 15 to 23 in were recorded in several locations. Heavy rains also triggered landslides in Korea, resulting in another six deaths. About 112 fishermen were unaccounted for after high seas disabled 11 vessels. Orchid weakened and began to turn extratropical in the Sea of Japan.

TYPHOON RUTH

Typhoon Ruth was the second of five typhoons occurring in September. Unlike the other typhoons, Ruth began as a monsoon depression in the South China Sea on September 11. For 2 days the depression remained quasi-stationary with the weak surface circulation embedded in the monsoonal trough. Synoptic data on the 13th indicated that the circulation was intensifying, and satellite imagery showed that it was forming its own outflow center.

By 1800 on the 13th the tropical depression had intensified to tropical storm Ruth and had started to track northwestward at an accelerated forward speed of movement. Ruth tracked along the southern periphery of the 500-mb ridge which was centered over southern Mainland China. She reached her first maximum intensity of 45 kn prior to landfall over Hai-Nan Tao, but quickly weakened to minimal tropical storm strength while over the island. Ruth entered the Gulf of Tonkin on the 15th and rapidly intensified to typhoon strength with a maximum surface wind of 65 kn and a minimum sea-level pressure of 975 mb.

Ruth made landfall early on the 16th south of Thanh Hou, Vietnam. Nearly half a million people were left homeless with 106 persons known dead or missing in Vietnam. Ruth also caused massive crop damages and

interrupted communications in the area.

TYPHOON PERCY

The disturbance which eventually developed into the tenth typhoon of 1980 became evident on September 13 as a focal point of cumulus banding. Aircraft reconnaissance soon afterwards found a well-developed, closed circulation with 1,500-ft flight-level winds of 35 kn and a minimum sea-level pressure of 992 mb. The first warning on tropical storm Percy was issued early on the 14th.

By this time the midtropospheric, midlatitude trough had moved eastward, and Percy's track shifted from a northward to a more climatological west-northwestward track as the ridge extended eastward north of Percy. Between September 15 and 17 reconnaissance aircraft consistently reported decreasing heights and increasing temperatures near the 700-mb center. During this time Percy decelerated and began moving erratically. He eventually completed two tight cyclonic loops while intensifying to typhoon strength by 0000 on the 16th.

During Percy's period of erratic movement, there was speculation that a Fujiwhara interaction might develop between Percy and then tropical storm Sperry, which was located 800 mi to the east. A comparison of the postanalysis best tracks for Percy and Sperry shows that the two vorticies were never close enough for an interaction to occur.

Interestingly, Percy did dominate much of the low-level circulation pattern between the two systems. A reconnaissance aircraft mission flown between Percy and Sperry indicated that the wind shift from southerly to northerly flow did not occur until about 100 mi west of Sperry's surface center (fig. 23). An aircraft fix at 1306 on the 17th indicated a 700-mb height of 2387 m, which extrapolates to a sea-level pressure of 919 mb and supports maximum sustained surface winds of 125 kn. Approximately 12 hr later typhoon Percy made landfall on the extreme southern tip of Taiwan, which so disrupted Percy's low-level inflow that he was never able to significantly re-intensify.

At 2100 on the 18th Percy made landfall on the coast of China about 240 mi east of Canton, with estimated maximum sustained surface winds of 45 kn.

The AMERICAN AQUARIUS was in the northeast quadrant of the storm on the 18th and 19th with 45-kn winds and waves up to 20 ft.

A few days earlier the GOLDEN PEAK had sent an S.O.S. that its main generator was out of order and the engineroom was flooded. The ship was in the Taiwan Strait close to Taiwan. The steering gear had failed initially. After drifting and then anchoring, the vessel started to drag towards Taichung. Both anchors gave way as Percy approached, and early on the 18th the GOLDEN EAGLE grounded hard near Taichung's rock causeway. During the afternoon the NEDLLOYD NAPIER, some 80 mi northwest of Percy's center, encountered 55-kn winds and a 994-mb pressure. Percy weakened and slowed as he headed for mainland China. Early on the 19th he crossed the coast about 50 mi northeast of Shantou. Once inland he dissipated rapidly.

Newspaper accounts of Percy's landfall over southern Taiwan indicated 7 dead and 16 injured. Heavy rain damaged 140 homes, flooded rice fields, and destroyed banana crops.

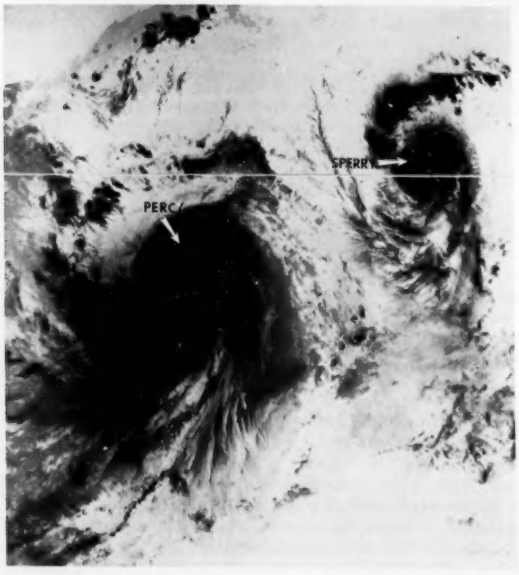


Figure 23.--Percy just prior to reaching typhoon intensity during the period of erratic movement over the Philippine Sea at 2311 on September 15. The eye of Sperry is located to the east-northeast of Percy. NOAA-6 Infrared Imagery.

TYPHOON SPERRY

Typhoon Sperry developed in the monsoon trough east-southeast of Guam. The disturbance was first reported on September 12 as an area of showers and thundershowers. Sparse synoptic data did not indicate that a surface circulation existed at that time. However, the upper air pattern was favorable for continued development. The initial warning for tropical depression 20 was issued at 0000 on the 15th, but postanalysis indicated that Sperry had actually attained tropical storm intensity by that time.

By the 16th southerly steering flow was evident south and east of Japan. A recurvature track and a weakening tendency over Japan were forecast. Sperry did, in fact, recurve, but significantly south of Japan as the subtropical ridge retreated to the southeast.

As Sperry began to recurve on the 17th, the estimated maximum surface windspeeds were consistently higher than supported by the maximum wind/minimum sea-level pressure (MSLP) relationship of Atkinson and Holliday (1977) (fig. 24). Maximum winds of 65 kn and MSLPs of 992 mb were observed by aircraft reconnaissance. A MSLP of 992 mb corresponds to a maximum wind of 45 kn. These stronger winds were probably due to an increased pressure gradient resulting from the higher pressures at subtropical latitudes. The TAKAYAMA MARU found 33-ft swells.

Sperry did not begin to weaken significantly until the 19th because his eastward movement kept him over warmer water for a longer period of time and also kept him south of the strong mid- to upper level westerlies which would have weakened him due to strong vertical wind shear.

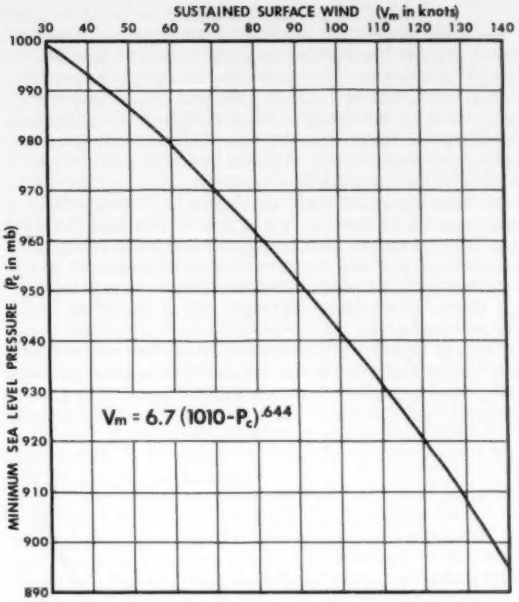


Figure 24.--The relationship between minimum sea-level pressure (mb) and maximum sustained surface winds (kn).

TYPHOON VERNON

During the latter part of summer, tropical cyclone activity in the northwestern Pacific reaches its peak. Multiple circulations develop within the Near Equatorial Trough and two (or more) cyclones of tropical storm or typhoon strength often exist at the same time.

If one tropical cyclone is located to the northwest of another developing circulation, it usually dominates and prevents the system to the southeast from intensifying as rapidly as it normally would. This is due primarily to the upper level outflow from the system to the northwest which enhances the climatological northwesterlies and restricts the outflow channels of the cyclone located to the southeast. The cyclone to the northwest is also, generally, the older of the two and has the opportunity to establish control of the low-level inflow. The development of the system to the southeast is, therefore, delayed until the other cyclone either ther weakens or moves far enough away from the Tropics that its influence becomes insignificant. Typhoon Vernon and tropical storm Thelma engaged in just such an interaction during the end of September and the beginning of October.

Vernon was first observed, as an area of increased thunderstorm activity, about 200 mi northeast of Eniwetok Atoll on September 26. Tropical storm Thelma was developing north of Guam. Thelma, although never more than tropical storm strength, nonetheless had a huge associated cyclonic circulation pattern which extended to at least the 500-mb level and covered most of the area between the Philippine Islands and Guam, and as far north as southern Japan. Because Thelma covered such a large area and was located to the northwest of Vernon, she robbed him of strong low-level inflow and restricted the upper level outflow in his northwest semicircle.

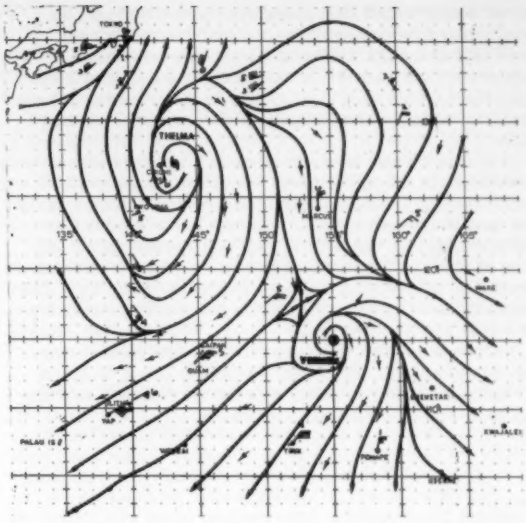


Figure 25.--Upper level streamline analysis (near 200-mb level) at 0000 on September 29. Data are rawinsonde and aircraft winds (⟶) and satellite-derived wind vecotrs (➝). Winds are in knots.

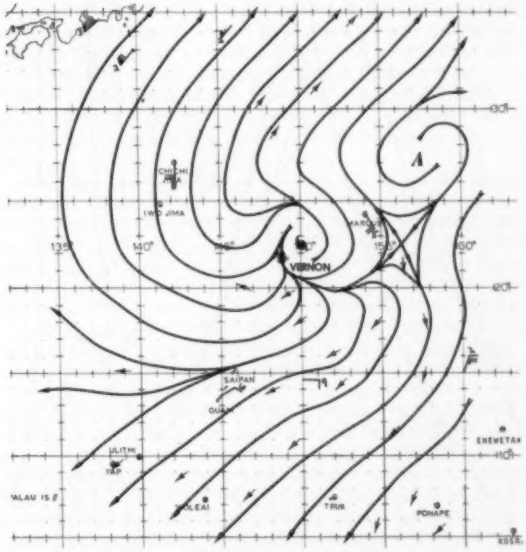


Figure 26.--Upper level streamline analysis (near 200-mb level) at 1200 on October 1. Data are rawinsonde and aircraft winds (⟶) and satellite-derived wind vectors (➝). Winds are in knots.

After the 28th Vernon began tracking more northwestward as he moved into the influence of the mid-

level trough which was associated with Thelma. He was steered by the southeasterly winds on the east side of this trough until October 2, when he came in contact with the southern extension of the midlatitude jetstream which accelerated him to the northeast, eventually to 53 kn. He reached typhoon strength on the 30th.

Figures 25 and 26 show a dramatic change which took place in the upper level flow pattern; the outflow from Thelma initially restricted Vernon's outflow in his northwest semicircle. Thelma had moved off to the northeast on October 1, and this opened up an outflow channel to the north and northwest which enabled Vernon to reach his maximum intensity of 105 kn. The YAMAHIDE MARU (38°N, 153°E) had northeasterly 60-kn winds and 23-ft waves.

Vernon made the transition to an extratropical system quite rapidly. Ship reports off the coast of Japan indicated that the remnants of Vernon continued to maintain gale-force winds until October 5.

SUPERTYPHOON WYNNE

The disturbance that eventually developed into supertyphoon Wynne was evident as early as September 30, although at that time it appeared to be simply enhanced convection embedded in the convergent inflow into typhoon Vernon. By October 2 the disturbance had separated from the inflow into Vernon, and the convective activity had increased in organization with good curvature and upper level outflow evident.

The small scale of the disturbance and the tightness of the circulation that characterized Wynne during most of her life prevented the circulation from appearing on synoptic analyses and led to an underestimation of severity during her formative stage. Postanalysis indicates that tropical storm strength was achieved as early as October 3.

Although typhoon Lex may have been the most interesting cyclone of the year in terms of movement, supertyphoon Wynne proved to be the most unusual in terms of intensity oscillations. As shown in figure 27 Wynne's

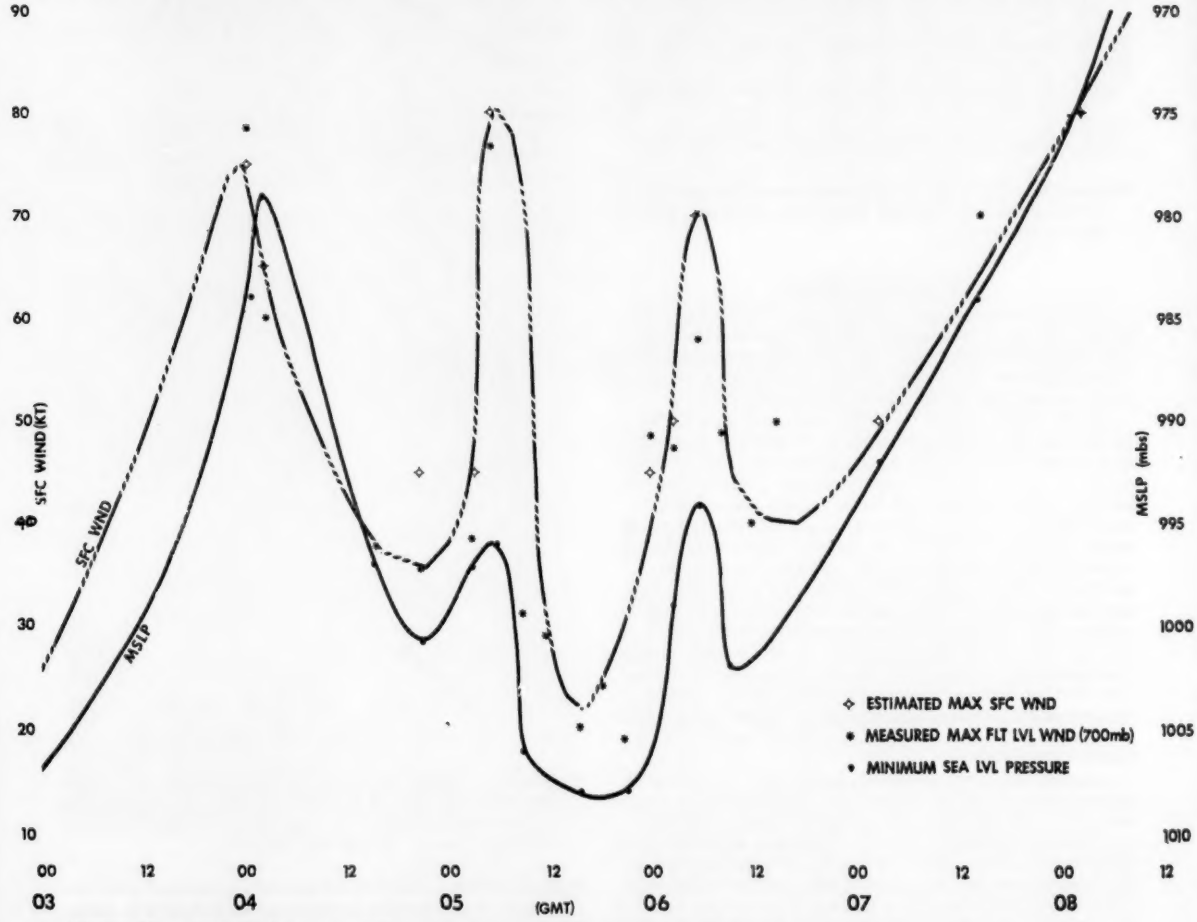


Figure 27.--Smoothed traces of Wynne's maximum windspeed and minimum sea-level pressure versus time for the period October 3 to 9, 1980.

early stage of development was characterized by short periods of rapid intensification and weakening, rather than by a typical smooth, gradual intensification. From October 3 to 7 Wynne's intensity and convective activity fluctuated significantly, as she attained typhoon or near typhoon strength only to weaken to near tropical-depression intensity three times following a diurnal cycle. Although not as marked as the oscillations in the observed maximum winds, the minimum sea-level pressure also exhibited a cyclical oscillation that closely approximated the periodicity of the maximum winds.

Wynne's third and final period of weakening occurred as she tracked 45 mi northeast of Guam. This weakening, combined with her small circulation, resulted in Wynne having virtually no effect on Guam. She continued to intensify rapidly following her third reintensification cycle at 1800 on the 7th, attaining supertyphoon strength just 30 hr later and a peak intensity of 150 kn (0600/09) in another 6 hr. Figure 28 depicts Wynne near maximum intensity about 490 mi southeast of Okinawa. Minimum sea-level pressure during this 35-hr period dropped from 982 mb to 890 mb--a 31-mb fall in 12 hr.

Wynne tracked north-northwestward past Guam and recurved 100 mi west of Okinawa. Her slow bend around the island brought over 2 days of torrential rain and winds gusting to more than 65 kn. Very few injuries were reported with farm crops receiving the major wind damage. A small island 30 mi northwest of Okinawa and closer to Wynne's path reported winds of 100 kn and severe damage. It was reported that 12 boats were lost or damaged. The SEMPOR and TEST HWA HO were both blown aground; all crewmembers were rescued.

Figure 28.--Supertyphoon Wynne near maximum intensity 49 mi southeast of Okinawa and 730 mi northwest of Guam at 2240 on October 9. NOAA-6 Imagery.

Once north of the ridge axis, Wynne tracked virtually straight east-northeastward on a heading of 070 degrees. This course kept her approximately 80 mi from the coast of Japan. Thirty- to forty-five kn winds were reported by Japanese coastal stations. Heavy rains claimed several lives and flooded over 1,000 homes.

As Wynne accelerated past Japan, the vertical wind shear and the influx of cooler, drier air resulted in rapid extratropical transition. The remnants of Wynne eventually were absorbed by a developing low-pressure system east of Japan.

TYPHOON BETTY

Betty, the 25th significant tropical cyclone of 1980, developed east of Truk Atoll. Just prior to passing south of Guam, Betty attained typhoon strength and then continued to intensify as she tracked into the Philippine Sea. About 12 hr prior to landfall on Luzon, Betty reached her peak intensity of 125 kn. During the 18 hr that Betty tracked over north-central Luzon, she weakened considerably, but in the process caused extensive damage and loss of life. Downgraded to tropical-storm strength, Betty moved northeastward through the Bashi Channel and eventually dissipated as a weak extratropical low southeast of Japan.

Betty had her origin in a weak disturbance south of Truk which showed increased potential for development on October 27 and 28. The first warning was issued at 0000 on the 29th with maximum surface winds of 30 kn. After passing south of Guam, typhoon Betty turned westward and continued to intensify, reaching 100 kn 48 hr later at about 2000 on November 1. At 0600 on the 4th she reached her peak intensity of 125 kn (fig. 29).

Packing 120-kn winds at 1600 on the 4th, Betty slammed into central Luzon south of Cape San Ildefonso. Most weather observing stations stopped reporting prior to Betty's approach, so her actual intensity as she crossed Luzon can only be inferred. However intense Betty may have been, there is little doubt that she was one of the most destructive typhoons of recent history. Initial reports received several days after Betty crossed Luzon indicated at least 81 people dead, thousands homeless, and extensive crop damage from flooding and mudslides. The Cagayan Valley in northern Luzon, hard hit by Betty, lost most of its rice crop from floodwaters which rose to rooftop level in some areas. Two ships under tow, the GENERAL SAN MARTIN and ANCAP CUARTO, took on water during the typhoon and suffered extensive damage. The ANCAP CUARTO was driven aground east of Baguio.

As Betty weakened over Luzon, the ridge that influenced her track into the Philippines broke down, thus allowing her to drift northward along the Cordillera central mountains and eventually to be drawn into the weak short-wave trough which had stalled off the coast of Taiwan. Emerging from Luzon as a 45-kn tropical storm, Betty never regained her earlier fury as she moved east of Taiwan and the Ryukyu Islands, undergoing an extratropical transition just prior to the 8th. As an extratropical system, the remnants of Betty did not persist long. This once powerful typhoon was last observed 12 hr later dissipating southeast of Honshu, near 32°N, 143°E.

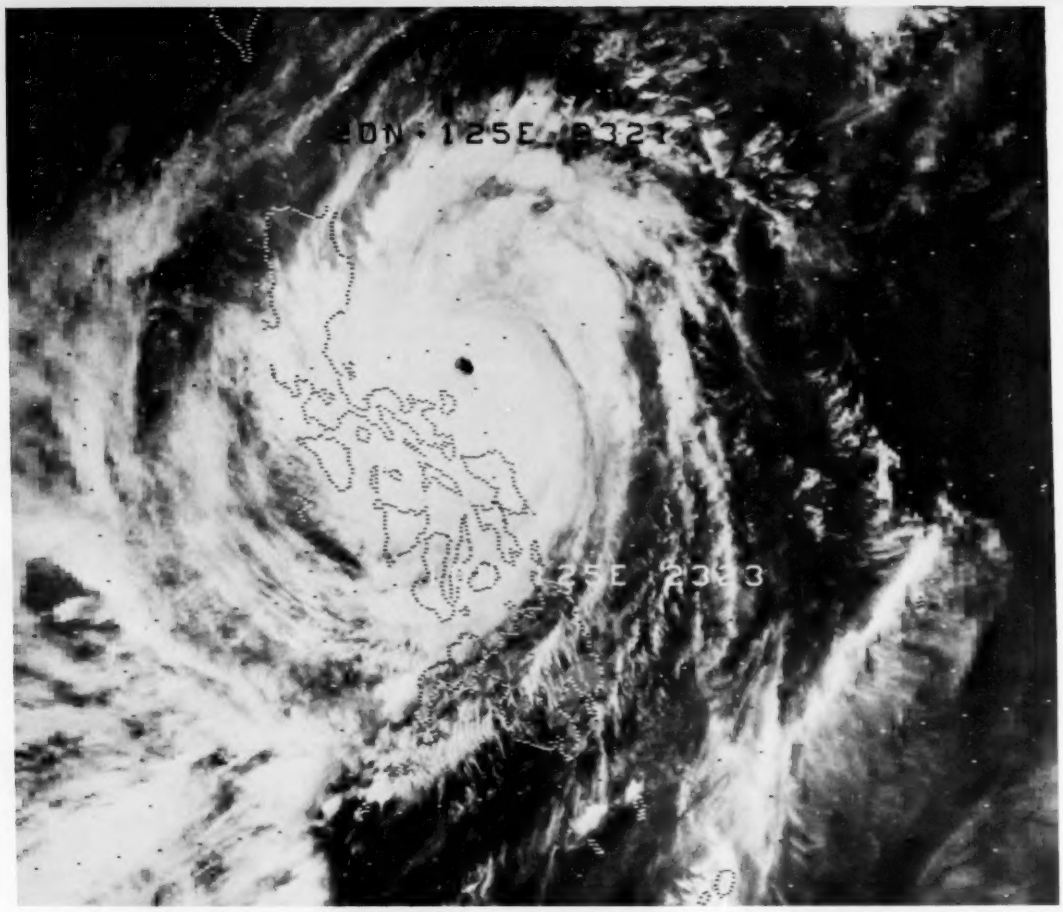


Figure 29.--Betty at peak intensity with 125-kn winds takes dead aim at Luzon.

TYPHOON DINAH

Dinah, the final typhoon of the 1980 season and the third tropical cyclone this season to threaten Guam, began to develop in mid-November as a focal point of cumulus banding embedded in the monsoon trough oriented east-west near Kwajalein. The first warning on tropical storm Dinah was issued at 0600 on November 21. At that time, having established a well-developed outflow to all quadrants, Dinah intensified rapidly and subsequently reached typhoon strength at 1800, just 12 hr after the initial warning.

By the time Dinah intensified to a typhoon, she posed a definite threat to Guam within 48 hr; thus, the decision was made to evacuate military aircraft from the island. Dinah was forecast to pass just off the northeastern tip of Guam, but the forecast was amended to near Saipan. Because Dinah was so compact, this small change in track was enough that Guam received very little wind as Dinah passed to the northeast, but Saipan and nearby Tinian received typhoon-force winds and sustained extensive damage.

Dinah continued to intensify rapidly as she began to move toward the northern Marianas Islands. She subsequently crossed the northeastern portion of Saipan at 1845 on the 22d and reached maximum intensity at 2100, with maximum sustained winds of 100 kn and gusts to 130 kn. Dinah began to recurve to the north on November 23. She then weakened and accelerated to the northeast in response to a midtropospheric long-wave trough which was moving eastward past Marcus Island on the 24th. Dinah transitioned to an extratropical cyclone by midday on the 25th.

Damage to the islands of Saipan and Tinian was massive, with 60 homes destroyed and another 214 suffering damages. Saipan, in the aftermath of typhoon Dinah, was completely without power for several days and 85 percent of the water system was not functioning. The Governor of Saipan estimated damages of $7 million. Shortly thereafter the area was declared a major disaster area, enabling the area to qualify for federal disaster fund relief.

Hints to the Observer

Robert G. Quayle
National Climatic Center
Environmental Data and Information Service, NOAA
Asheville, N.C.

WIND DIRECTION BIAS

Over the past 10 yr we have presented illustrations of direction bias in several issues of the Log. The March 1971 case study (data from 1968-69) was quite striking, but the most recent run (based on July 1976 data, rerun in the March-April 1981 issue) showed some improvement. We wondered if the past 5 yr had shown further improvement, so I asked Early Funderburk, III, a met-programmer at this Center, to run the same type of summary for January 1981 data (fig. 30), this time separating estimated and measured winds (which now appear to be split nearly 50-50 for U.S. ships).

The results are about the same as the 1976 test. Measured winds show only slightly less biasing than estimated.

As a comparison and to show the vast improvement of direction bias, the 1968-69 data is illustrated in figure 31.

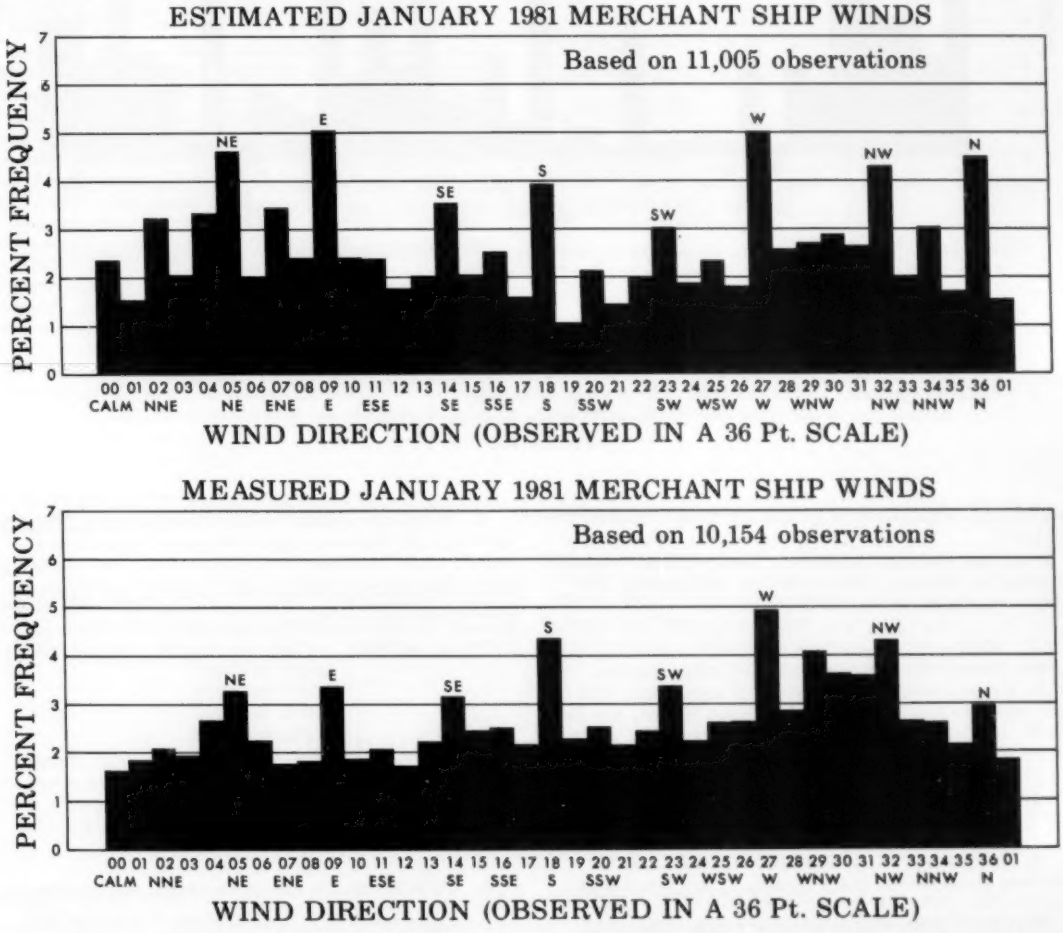

ESTIMATED JANUARY 1981 MERCHANT SHIP WINDS
Based on 11,005 observations
PERCENT FREQUENCY
0 1 2 3 4 5 6 7
NE
E
SE
S
SW
W
NW
N
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 01
CALM NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW N
WIND DIRECTION (OBSERVED IN A 36 Pt. SCALE)
MEASURED JANUARY 1981 MERCHANT SHIP WINDS
Based on 10,154 observations
PERCENT FREQUENCY
0 1 2 3 4 5 6 7
NE
E
SE
S
SW
W
NW
N
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 01
CALM NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW N
WIND DIRECTION (OBSERVED IN A 36 Pt. SCALE)

Figure 30. -- January 1981 data showing the percent frequency distrbution estimated (top) and measured (bottom) of wind direction.

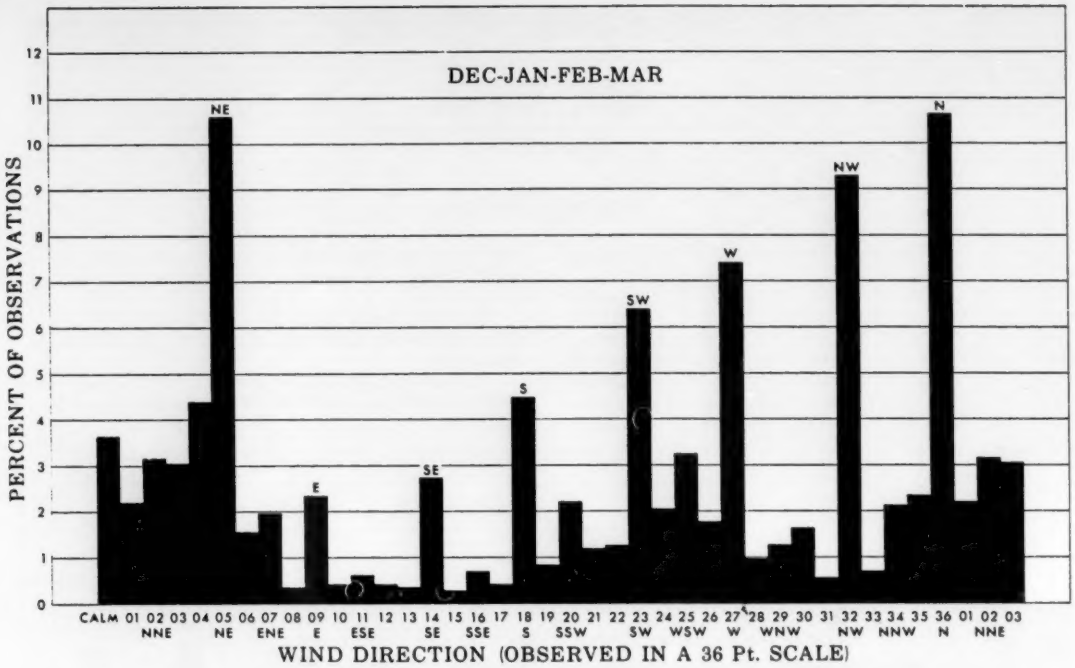


Figure 31. -- The 1968-69 data. By comparing this figure with figure 30 you can see the vast improvement in 1981 in eliminating the bias to the cardinal and intercardinal points.

Tips to the Radio Officer

Larry Murphy
National Weather Service, NOAA
Silver Spring, Md.

NATIONAL WEATHER SERVICE CW COMMUNICATION POLICY

In the last issue in the Marine Observations Program column we promised the new policy for handling CW ship's weather reports. It is :

1. Always try to send your CW ship's weather reports through the U.S. Coast Guard radio stations. U.S. Coast Guard radio station call signs start with the letter N; i.e., NMF Boston, NMA Miami, and so forth, as listed in the NOAA publication Radio Stations Accepting Ships Weather and Oceanographic Observations. The preferred priority for those ships with the proper equipment is: (1) U.S. Coast Guard SITOR; and (2) U.S. Coast Guard CW.

2. Although it is usually best to transmit to the nearest Coast Guard radio station, if there is a backup or other difficulty getting through, try any other Coast Guard radio station you can reach. This will also help to distribute the synoptic-hour load among the Coast Guard radio stations.

3. If you are unsuccessful, after making a diligent try to get the weather report received by the Coast Guard, shift to a commercial station as listed in the Radio Stations Accepting Ships' Weather and Oceanographic Observations. The times that NWS will accept and pay for ship weather reports is restricted to the following periods:

0000Z to 0300Z
0600Z to 0900Z
1200Z to 1500Z
1800Z to 2100Z

The weather report should be only for the current synoptic hour. Older reports for sparse data areas should be sent by Coast Guard radio stations only. Older reports not in data-sparse areas should not be transmitted.

4. STORM reports are an exception and will be accepted any time from any station.

Comments

There are never enough ship weather reports, so

this policy should not be interpreted as meaning that we can accept a decrease in number or quality. In fact, we are trying to encourage the receipt of more reports closer to the synoptic hour.

At the National Meteorological Center (NMC), where all weather reports go, they have several data "cut-off times." That is when the NMC computers stop accepting weather reports and start computing forecaster guidance products and weather maps from the weather reports. As an example, if the weather report from your ship is received within 1 hr 10 min after the synoptic time, it will be used in and influence all of the guidance products, all of the weather maps, forecasts, and warnings. It will also be used on the marine facsimile maps. As the report gets progressively older it cannot be used on products issued previous to its receipt at NMC. The final hemispherical weather map which is used as the base for the next synoptic time maps and forecasts is plotted starting at 4 hr 20 min after the synoptic hour. All observations received previous to that time will appear on that map. However, the forecasts and warnings have already been issued.

Weather information is perishable with time. Please transmit the weather reports with the highest priority available so that they can arrive at NMC by 1 hr plus 10 min after observation time.

Most weather reports transmitted to the Coast Guard are relayed to NMC over NWS circuits. This allows some forecast offices to see and utilize the weather reports before they reach NMC.

The commercial radio stations provide a valuable service to the mariner in disseminating forecasts and warnings as well as providing a back-up for receiving weather reports when the Coast Guard circuits become jammed. But due to current budgetary constraints, funds are limited for this service.

NEW EDITION OF WORLDWIDE MARINE WEATHER BROADCASTS TO BE AVAILABLE SOON

The 1981 edition of Worldwide Marine Weather Broadcasts has been sent to the printer. It should be distributed in early July.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JUNE 1980 EDITION)

Page 53

Delete the following stations:
2-1255 Mud Bay, Alaska -- WRN 43
2-1262 Juneau, Alaska -- WGG58

2-1220 King Salmon, Alaska, U.S.A. -- KCI 98
Change to read:
0200, 2000 4125(A3) S, F

Page 54

Delete the following stations:
2-1271 Petersburg, Alaska -- WRN42
2-1272 Lena Point, Alaska -- WRN40
2-1279 Ketchikan, Alaska -- WRN41
2-1281 Ketchikan, Alaska -- WGG56
2-1285 Sitka, Alaska -- WDU29

Page 56

2-1530 Honolulu, Hawaii, U.S.A., -- NMO
Change times to read:
0545, 1145, 1745, 2345

Page 63

3-0070 Bracknell, United Kingdom -- GFA
In schedule add:
0830 Schedule changes

3-0080 Brachnell, United Kingdom -- GFE
Change time of radio frequency check to 1400 only
In schedule add:
0830 Schedule changes

Page 64

3-0135 Offenbach/Main, Fed. Rep. of Germany
Change times 0355 to 0359, 0946 to 0945
1145 to 1148, 1555 to 1553, 1759 to 1659
0528 to 0530, 1049 to 1053, 1728 to 1741,
2250 to 2252, 1100 to 1102.
Delete 0559.

Page 66

3-0220 Rome, Italy -- IMB
Change: 0625 to 0445, 1050 to 1045,
1825 to 1645, 1020 to 1045, 0350 to 0500
1225 to 0830, 1550 to 1700, 2230 to 2030
Delete Preliminary surface analysis and
test chart.

Marine Observations Program

J.W. Nickerson
National Weather Service, NOAA
Silver Spring, Md.

COMMUNICATIONS

The National Weather Service CW communication policy is stated under "Tips to the Radio Officer" on page 254.

COASTAL OBSERVATIONS

There has been an increase in the number of weather observations near shore. Some probably as close in as the sea buoy.

In recent telephone calls we have been asked why near-shore observations are needed when there are coastal weather reporting stations. The answer is in the characteristics of the surface over which the wind blows. Over land there are hills, buildings, and trees to interrupt and slow the wind. Over the water the surface is relatively smooth and the air can flow with much less resistance. Naturally, the winds are stronger over the water.

The surface temperatures of land and ocean are rarely the same. In the winter, the land is colder than the ocean and in the summer the reverse is true, the land is warmer. Even on a daily basis the land cools at night and warms during the day while the ocean temperatures remain relatively steady.

Temperature affects the stability and pressure of the air. Generally, warmer surface temperatures mean lower pressure and unstable air; cold surface temperatures mean higher pressure and stable air. If there is a marked change in temperature at the coast, there will be an affect on the wind.

So that is the problem. We do not know these winds, pressures, and temperatures without near-shore ship observations. Consequently, it is difficult to determine where the wind starts to accelerate; sometimes the increasing winds won't start until several miles offshore. How far does it continue to accelerate? Sometimes it will be confined to a narrow band of a few miles. At other times the accelerating winds develop rapidly into storm conditions. Only ship observations can give the forecaster the needed information to sort out the potential storm development from a minor blow.

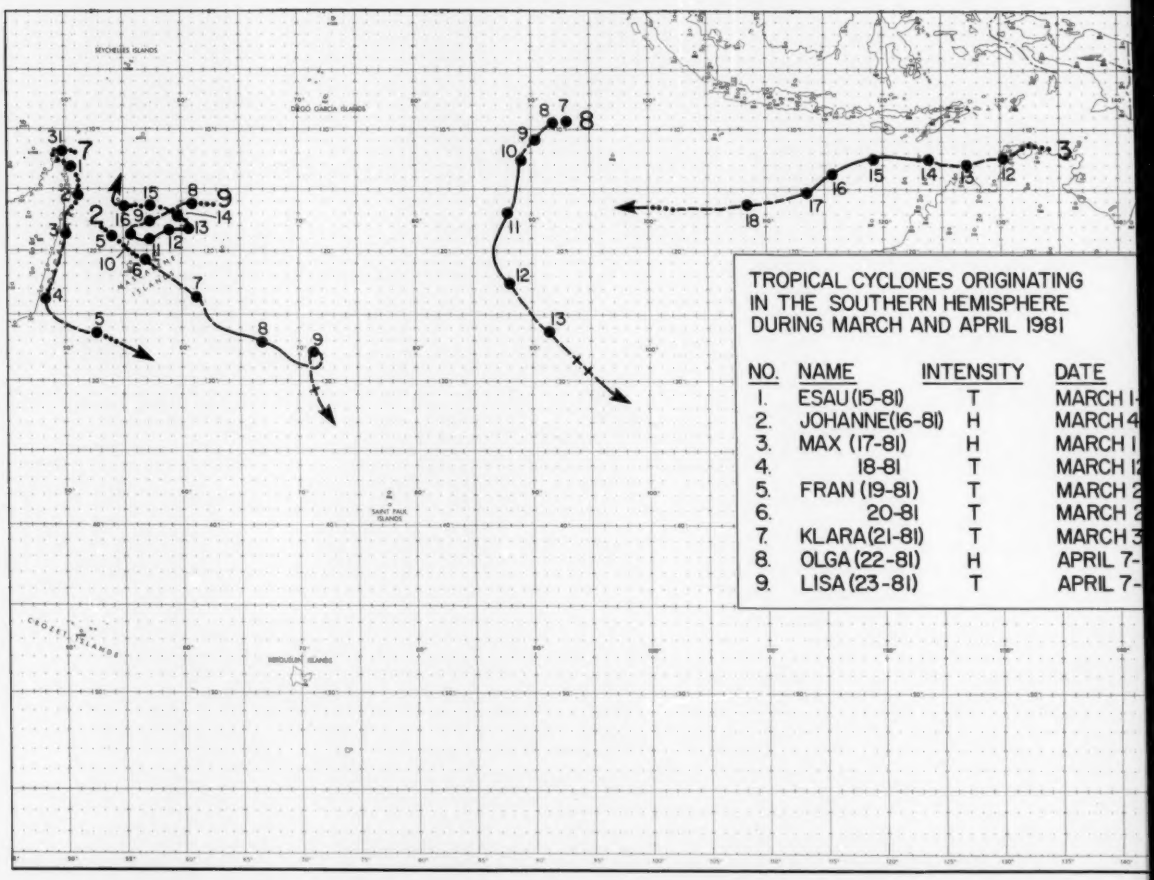

SEYCHELLES ISLANDS
DIEGO GARCIA ISLANDS
MARIANA ISLANDS
SAINT PAUL ISLANDS
CROZET ISLANDS
KERGUELEN ISLANDS
TROPICAL CYCLONES ORIGINATING IN THE SOUTHERN HEMISPHERE DURING MARCH AND APRIL 1981
NO. NAME INTENSITY DATE
1. ESAU (15-81) T MARCH 1-
2. JOHANNE (16-81) H MARCH 4
3. MAX (17-81) H MARCH 1
4. 18-81 T MARCH 1
5. FRAN (19-81) T MARCH 2
6. 20-81 T MARCH 2
7. KLARA (21-81) T MARCH 3
8. OLGA (22-81) H APRIL 7-
9. LISA (23-81) T APRIL 7-

Figure 32.--Tropical cyclone tracks, Southern Hemisphere, March and April 1981.

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D. C.

SOUTHERN HEMISPHERE
MARCH AND APRIL 1981

Activity during this period was slightly above normal (9 tropical cyclones, 3 hurricanes) due to a flurry of storms in March; seven of the nine tropical cyclones developed in March. Only Johanne, Max, and Olga reached hurricane intensity (fig. 32).

Notable were a lack of activity around Australia (only Max in his early stages) and the eastward extent of two tropical storms from the Society Islands area. Max threatened Darwin with gale-force winds on March 11. Reports indicated gusts to 80 kn and 5.4 in of rain at the port as Max headed across the Bonaparte Gulf. On the 14th he reached hurricane strength; the following day winds near his center were estimated near 100 kn with gales extending out 150 mi. Farther east, two tropical storms formed in the Fiji Island area in March. Esau developed north of the Fiji Islands and moved through the Samoa Islands on the 3d while another system (20-81) popped up to the south toward the end of the month. The Society Island storms also came to life in March. Both were detected at fairly high latitudes, and it is suspected that their existence extends back at least a few days. Both had winds estimated at about 50 to 55 kn at their peak. Tropical storm 18-81 was tracked east of 140°W on a path similar to that of hurricane Robert back in April of 1977; these are rare storms that track so far east.

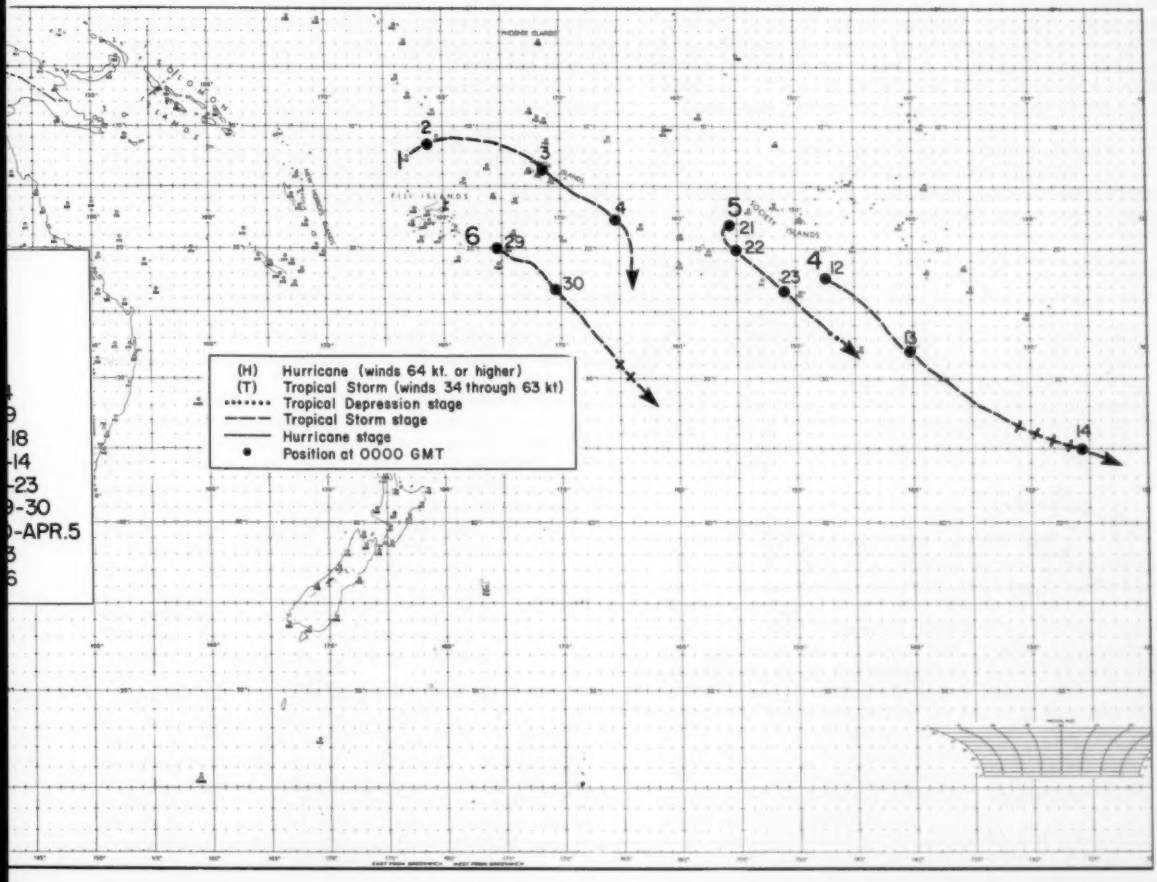


Table 5.--Global tropical cyclone summary, March and April 1980

No.	Name	Peak Intensity	Est. max. wind (kn)	Est. min. sea-level pressure(mb)	Basin	Dates
1.	Laure	H	100	965	S. Indian	March 8-17
2.	Sina	H	70	978	Aust.-S. Pacific	March 10-16
3.	15-80	T	40	992	S. Indian	March 14-20
4.	Doris	T	45	990	Aust.-S. Pacific	March 14-19
5.	Gloria	H	110	942	Aust.-S. Pacific	March 21-28
6.	Tia	T	60	982	Aust.-S. Pacific	March 21-27
7.	Val	T	60	978	Aust.-S. Pacific	March 25-29
8.	Wally	T	50	986	Aust.-S. Pacific	April 1-8
9.	Carmen	T	60	980	W. North Pacific	April 4-9

Of the four South Indian Ocean storms, three roamed the waters between Madagascar and the Mascarene Islands, while one, hurricane Olga, played about in midocean. Olga was at hurricane strength from about April 9 through 12, and her top winds were estimated at 110 kn on the 11th. Lisa was the other April storm and was confined to a small looping path among the Mascarene Islands. Tropical storm Klara at the end of March and into early April hugged the east coast of the Malagasy Republic. Johanne was a hurricane only after crossing the 25th parallel on March 7. Her maximum winds were estimated at 75 kn that same day.

GLOBAL TROPICAL CYCLONES MARCH AND APRIL 1980

Nine tropical cyclones developed during this 2-mo period; eight in the Southern Hemisphere (fig. 33). Only three reached hurricane strength. This activity was actually very close to the normal of eight tropical cyclones including three hurricanes. April is usually the least active month of the year.

The Fiji Islands had a rough time as three tropical cyclones passed through the Islands inside of 2 weeks. While none of the trio were hurricanes, their power came from torrential rain-producing floods and slides along with storm tides. Over a 3-day period Wally dumped up to 33 in of rain on the Suva area. Gloria was the most intense storm of the 2-mo period as winds near her center climbed to an estimated 110 kn late on the 25th (table 5). Laure's 100-kn winds churned up the seas between Mauritius and Reunion. Carmen was the only Northern Hemisphere storm, and she meandered back and forth across the date line before dissipating.

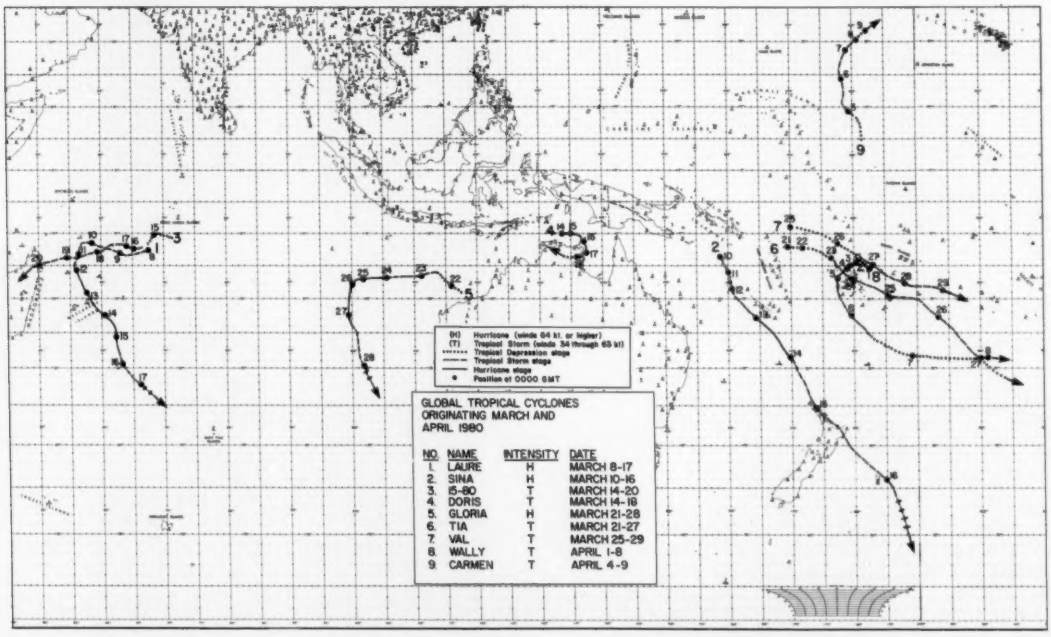

(H) Hurricane (winds 64 kt. or higher)
(T) Tropical Storm (winds 34 through 63 kt)
Tropical Depression stage
Tropical Storm stage
Hurricane stage
Position at 0000 GMT
GLOBAL TROPICAL CYCLONES
ORIGINATING MARCH AND
APRIL 1980
NO. NAME INTENSITY DATE
1. LAURE H MARCH 8-17
2. SINA H MARCH 10-16
3. 15-80 T MARCH 14-20
4. DORIS T MARCH 14-18
5. GLORIA H MARCH 21-28
6. TIA T MARCH 21-27
7. VAL T MARCH 25-29
8. WALLY T APRIL 1-8
9. CARMEN T APRIL 4-9

Figure 33.--Global tropical cyclone tracks, March and April 1980.

TROPICAL CYCLONE WATCH - 1981

The tropical cyclones that have developed through July 1981 appear in table 6. This list is preliminary.

Table 6.--World tropical cyclone watch, 1981

South Indian Ocean			
Florine	01-81	H	Jan.
	04-81	T	Jan.
Helyette	06-81	T	Jan.
	10-81	T	Feb.
Johanne	16-81	H	March
Olga	22-81	H	April
Lisa	23-81	T	April
Paddy	24-81	T	May
Western North Pacific			
Freda		H	March
Gerald		T	April
Holly	TC-3	T	April
Ike	TC-4	T	June
June	TC-5	H	June
Kelly	TC-6	H	June
Lynn	TC-7	T	July
Maury	TC-8	H	July
North Atlantic			
Arlene		T	May
Bret		T	June
Australia-South Pacific			
Arthur	02-81	T	Jan.
Mabel	03-81	H	Jan.
	05-81	H	Jan.
Betsy	07-81	T	Jan.
Cliff	08-81	H	Jan.
Eddie	09-81	T	Feb.
Daman	11-81	T	Feb.
	12-81	T	Feb.
Neil	13-81	H	Feb.
Freda	14-81	H	Feb.
	15-81	T	March
Max	17-81	H	March
	18-81	T	March
Fran	19-81	T	March
	20-81	T	March
Klara	21-81	T	April
Eastern North Pacific			
Adrian	TD-1	T	May
Beatrix	TD-2	H	June
Calvin	TD-3	T	July
Dora	TD-4	H	July
Eugene	TD-5	T	July

On the Editor's Desk

A NEW KIND OF STORM

NOAA scientists have identified a convective weather system whose features appear different from other thunderstorm systems. NOAA's Office of Weather Research and Modifications (OWRM) calls these systems Mesoscale Convective Complexes (MCCs). Although their physics are not yet understood, they are highly organized and long-lived, are frequently observed at both middle and low latitudes, and may help to shape the atmosphere large-scale circulation.

OWRM in Boulder recently investigated the small but long-lived MCC that caused the disastrous Johnstown, Pa., flood in July 1977. This severe storm appears to be the midlatitude counterpart of a tropical weather system--convectively-driven, with an extensive high cirrus cloud shield, and not associated with weather fronts. Midlatitude MCCs previously were regarded as more or less random thunderstorm activity. But now it is believed that these are organized systems, which implies a predictability that should be exploited.

It has been shown that MCCs can boost nearby jet stream winds and change their direction. Convective storms are typically considered to be controlled by the evolution and movement of large-scale circulation features. But since those features may be significantly modified by the storm, "chicken and egg" questions become extremely important.

The notion that giant thunderstorms can help to drive the large-scale circulation was first put forth around 1880. In 1958 tropical meteorologist Herbert Riehl suggested how cumulonimbus "hot towers" embedded in tropical weather systems could force warm air upward and poleward to help power the Earth's weather machine. These hot towers give MCCs most of their punch. Calculations show that an average tropical MCC contains about eight of these giant thunderstorms, while midlatitude MCCs, which are often larger, may contain about 20.

It may be that tropical hot towers and MCCs are closely related to the processes being studied by NOAA's Equatorial Pacific Ocean Climate Studies (EPOCS) program. This multi-year study is exploring the possibility that the variability of equatorial sea-surface temperature (SST) is a fundamental driving force for midlatitude climate changes. Although the place of SST changes in the chain of cause and effect is uncertain, EPOCS scientists agree that the ocean climate link should involve the release of heat from the sea to the tropical atmosphere by great convective storms.

The upshot of all this NOAA research may be that global thunderstorm activity, including MCCs, may have an important impact on the large-scale circulation features that help to shape our weather and climate. Many aspects of this intense convective activity, including its origins, oceanic and continental, are now being investigated.

GUIDE TO MARINE SCIENCE ACRONYMS

The third edition of a guide to acronyms and abbreviations of the marine sciences has been published by NOAA.

This revised, expanded edition of a reference work first issued in 1969 is now titled Annotated Acronyms and Abbreviations of Marine Science Related Activities. At 349 pages, it is three times as long as the second edition. It was produced by the National Oceanographic Data Center to help research scientists, program managers, students, technical writers, and others cope with a literature strewn with acronyms of marine science organizations, programs, projects, expeditions, instruments, and institutions.

Originally covering only acronyms and abbreviations of international marine science activities, this publication now includes five major sections: international organizations; international programs, projects, and expeditions; U.S. national organizations; foreign organiza-

tions; and terms. The U.S. section covers Federal and State government and regional and private organizations. The foreign section is a survey by country. Acronyms and abbreviations are described in context by entries arranged to show pertinent relationships. Two alphabetica indexes--one listing acronyms and abbreviations and the other listing full titles--provide keys to the text entries.

The publication is available for a $3 handling charge from the National Oceanographic Data Center (D761), EDIS/NOAA, Washington, DC 20235.

NEW PACIFIC MARINE FACSIMILE PRODUCTS

The new marine facsimile products for the Pacific coast of North America have been described in the last two issues of Mariners Weather Log (March-April and May-June 1981). Figure 34 gives the transmission schedule for these forecasts and analyses from NMC, Point Reyes, Calif.

USCG COMMUNICATION STATION, POINT REYES, CALIFORNIA....NMC
RADIOFACSIMILE TRANSMISSION SCHEDULE
NOAA NATIONAL WEATHER SERVICE, SAN FRANCISCO, CALIFORNIA

TIME	AREA	CHART	TIME	AREA	CHART
1500Z		TEST PATTERN SYMBOLS	0100Z	3	SURFACE FORECAST VT 12Z
1510	3	SEA SURFACE THERMAL ANALYSIS	0110	4	SURFACE FORECAST VT 12Z
1520	4	SEA SURFACE THERMAL ANALYSIS	0120	5	SURFACE FORECAST VT 00Z
			0130	6	SURFACE FORECAST VT 00Z
1700Z	5	12Z SURFACE ANALYSIS			
1710	6	12Z SURFACE ANALYSIS	0300Z	3	SEA SURFACE THERMAL ANALYSIS
			0310	4	SEA SURFACE THERMAL ANALYSIS
2000Z	5	12Z SURFACE ANALYSIS			
2010	6	12Z SURFACE ANALYSIS	0400Z	5	00Z SURFACE ANALYSIS
2020	5	SEA SURFACE TEMP ANALYSIS	0410	5	72HR EXTENDED OUTLOOK VT 12Z
2030		FACSIMILE SCHEDULE			
			0530Z	5	00Z SURFACE ANALYSIS
2200Z	5	18Z SURFACE ANALYSIS	0540	5	72HR EXTENDED OUTLOOK VT 12Z
2210	6	18Z SURFACE ANALYSIS	0550	3	NASA/JPL EXPERIMENTAL
			0600	4	NASA/JPL EXPERIMENTAL
2300Z	3	NASA/JPL EXPERIMENTAL	0610	5	NASA/JPL EXPERIMENTAL
2310	4	NASA/JPL EXPERIMENTAL			
2320	5	NASA/JPL EXPERIMENTAL			

AREA: 3 = 40N-52N, EAST OF 135W.
4 = 28N-40N, EAST OF 132W.
5 = 30N-60N, EAST OF 160E.
6 = 20S-30N, EAST OF 160W.

FREQ(KHZ): 0100-1500Z 4344.1, 8680.1, 12728.1.
1700-2300Z 8680.1, 12728.1, 17149.3.

COMMENTS ON SCHEDULE OR CHARTS ARE INVITED. CALL NMC DIRECT OR WRITE NATIONAL WEATHER SERVICE, 660 PRICE AVE., REDWOOD CITY, CALIF. 94063. VISIT US WHEN IN PORT.

Figure 34.--Radiofacsimile schedule for NMC, Point Reyes, Calif.

SATELLITES SHUNTED, SHIFTED, AND LAUNCHED

A worn-out weather satellite--the SMS-1--became the first ever consigned to the "trash can" of upper space. It was shunted 300 mi farther into space where it will remain indefinitely. NOAA feared disposing of it in the traditional manner because of a possible collision with other spacecrafts.

Nonfunctioning satellites normally are dropped into the atmosphere to burn up or shifted to a lower orbit. Because of the large number of weather and communications satellites accumulating in geostationary orbit, there is a real danger of collision between active satellites and old derelicts which no longer can perform the small maneuvers necessary to keep them in their assigned locations. For this reason, the last remaining fuel on board the satellite was used to move it up and out of its orbit.

SMS-1 made space history in May 1974 when it became the first geostationary satellite launched into space for use by weather forecasters at NWS. However, it is now no longer able to provide useful data.

Controllers at the Satellite Service in Suitland, Md., radioed commands to the spacecraft that caused its thrusters to propel it 300 mi above its orbit at 130°W longitude and 22,300 mi above the Equator.

Meantime, what is believed to be the first mass shifting of satellites in space is now being undertaken by NOAA. The maneuvers are occurring at an altitude of 22,300 mi, where three weather satellites are being moved to new locations to improve their products and, in one instance, eliminate the possibility of a collision in the busy corridor.

The newest of the satellites, GOES-4, launched last September 1980, is being moved from 98° to 135°W longitude to replace a failing GOES-3 satellite. A third spacecraft, GOES-2, was moved from 105° to 107°W on January 29 to reduce the likelihood of it colliding with other satellites or space debris.

In March NASA launched a seventh geostationary satellite to replace the SMS-2 East Coast spacecraft at 75°W. SMS-2 will be moved to a nearby location on stand-by status.

SEATTLE PMO MOVES

Don Olson, the Seattle Port Meteorological Officer, will be moving to new quarters with the NOAA Western Regional Center at Sand Point on July 27, 1981. The new address and telephone number for his office will be:

Port Meteorological Office
OA/WSFO SEA PMO
National Weather Service, NOAA
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115
(Telephone: 206-527-6100)

IMPROVED NOAA SATELLITE LAUNCHED

A new environmental monitoring satellite was launched on June 23, giving the fishing and marine transportation industries, weather forecasters, and others access to improved sea-surface temperature information.

The satellite, known as NOAA-7, carries the most versatile scanning radiometer ever sent aloft. It can gather visual and infrared imagery and measurements in five spectral channels. The data will permit more accurate evaluation of land, ice, and water-surface temperatures, as well as clouds.

The sea-surface temperature data will be valuable to West Coast and Gulf of Alaska fishermen and shipping interests along the East Coast and in the Gulf of Mexico. Fishermen use charts of sea-surface temperatures to pinpoint productive fishing grounds. Many credit the charts with helping improve catches and to cut fuel costs. Shippers use similar charts for the Gulf Loop Current and Gulf Stream, saving time and money.

Two earlier TIROS-N satellites carried four-channel radiometers. One is still operational. The NOAA-7 satellite was launched from Vandenberg Air Force Base, Calif.

GREAT LAKES BUOY NETWORK

The NOAA Data Buoy Office (NDBO) has started its third season of operating buoys in the Great Lakes.

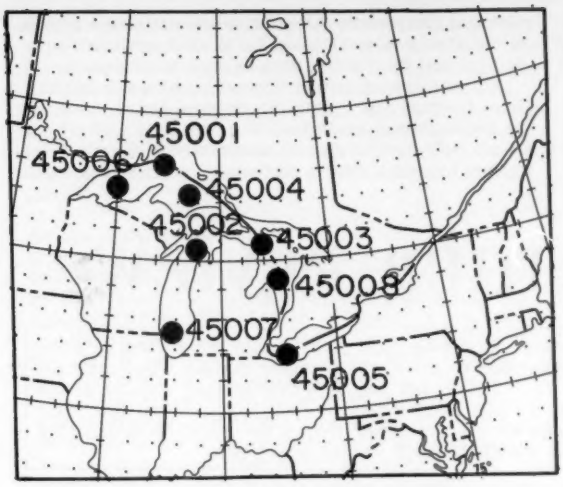


Figure 35.--Location of Great Lakes weather buoys.

Table 7.--Great Lakes buoy system

Buoy No.	Lake	Lat./Long.	Status
45001	Superior	48.0°N, 87.6°W	in and operating
45002	Michigan	45.3°N, 86.3°W	in and operating
45003	Huron	45.3°N, 82.8°W	in and operating
45004	Superior	47.2°N, 86.5°W	in and operating
45005	Erie	41.7°N, 82.5°W	in and operating
45006	Superior	47.3°N, 90.0°W	in and operating
45007	Michigan	42.7°N, 87.1°W	to be positioned July 7, 1981
45008	Huron	44.3°N, 82.4°W	to be positioned in late July or early August '81

This year the network will expand to eight stations (fig. 35 and table 7).

The Data Buoy program in the Great Lakes has multiple purposes. It was initially conceived as a way by which weather at data sparse areas could be routinely sensed and reported.

Wave height and period are measured and reported by each buoy hourly, providing marine interests with reliable indications of lake conditions. Also reported in the standard NDBO meteorological sensor package are windspeed and direction, air temperature, barometric pressure and surface water temperature. The buoys help fill a void of weather observations created when Coast Guard light stations were automated and the buoys provide data that will aid in predicting the onset of pack ice formation in the Lakes.

The buoy systems being deployed in the Great Lakes use a boat-shaped aluminum hull NOMAD buoy. Fully loaded it weighs about 14,000 lb, which allows it to be hoisted and placed on deck of Coast Guard buoy tenders servicing the buoys. Batteries which power the buoys are good for 2 yr of operation. The buoys are moored in water depths ranging from 45 ft to 810 ft, utilizing chain or chain and nylon configurations. Anchors are usually large concrete sinkers.

The first two stations (45001 and 45002) were established in 1979. Five stations were operating in 1980 and six at the beginning of this year.

The buoys are recovered for the winter. Floating lake ice as well as top-heavy ice loading prevents leaving the buoys on station throughout the winter.

To maintain the moorings in place, marker buoys of a modified Coast Guard NUN buoy design are used to support the moorings over the winter. The buoys are redeployed in the spring. The mooring support buoys have been found intact, where they were supposed to be, although most of their paint had been scraped off.

In general, all stations have been operating highly satisfactorily, reporting about 95 to 98 percent of data acquired. These data, sampled on an hourly basis, are transmitted in real time over National Weather Service circuits for use in forecasting. The observations are especially useful in updating the current weather and forecasts broadcast over the NOAA Weather Radio. Buoy data are also archived and stored for scientific studies within NOAA's National Climatic Center and the National Oceanographic Data Center. Data are made available to the public from these centers for various studies.

LIGHTNING

Benjamin Franklin, in 1750, was the first to design an experiment to show that clouds are electrically charged. Although experimental techniques have advanced tremendously since Franklin flew his famous kite, studies of atmospheric electricity, with a few exceptions, are still conducted on a string. This is the reason why, in spite of the important progress being made by NOAA's National Severe Storms Laboratory and a handful of other research groups, thunderstorm electrification remains one of the major mysteries of the atmosphere.

Some researchers believe that the mystery of thunderstorm electricity, as it affects the generation of lightning and rainfall, is only the beginning of the electrical enigma that meteorologists must come to grips with. There is the even greater mystery of the suspected electrical hookup between thunderstorms, the Earth's global electrical circuit, and space.

Scientists know that global thunderstorm activity powers the electrical circuit and that ionizing particles (galactic x-rays) also produce changes in the circuit. But how do convective clouds respond to these externally induced electrical changes? This question goes right to the heart of thunderstorm microphysics, in terms of the effects of electrical forces on the growth of ice crystals and raindrops. Cloud physics experts insist that such details must be understood before we can really explain storm dynamics.

Many independent research findings, taken together, suggest that these externally induced electrical changes help to regulate global thunderstorm acticity, which in turn helps to regulate the atmosphere's large-scale circulation.

Significant weather and climate changes are involved, making this a matter of practical concern to NOAA. Electrical processes are unaccounted for in the physics

of today's numerous forecast models, and weather forecast errors occurring in step with Sun-induced electrical changes have been documented. However, other sources of error are estimated to be more important at the present time.

It is over the long term that these suspected electrical effects are most obvious. Great swings in climate often coincide with strong changes in incoming high-energy particles or radiation. It is reasonable to expect that electrically forced climate variations also occur on time scales between the short-term weather changes and their more obvious long-term trends.

A great deal of research must be done to confirm these findings and clarify the physical links. However, the evidence now available, when taken as a whole, seems sufficient to elevate the stature of the electrical-forcing hypothesis from conjectural to probable.

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

January and February 1981

SMOOTH LOG, JANUARY 1981--The most traveled storm path was from about 400 mi east of Cape Hatteras to the Denmark Strait. The area of cyclogenesis off the U.S. East Coast was about 200 mi farther east than usual. Fewer storms than usual passed over the Great Lakes Basin. Three storm systems affected the central Mediterranean.

The mean sea-level pressure pattern was shifted counterclockwise. The Icelandic Low was a normal 1001 mb, but shifted from 60°N, 35°W, to 58°N, 54°W. The Azores High was 13 mb higher than normal at 1033 mb and from near 35°N, 20°W, to 43°N, 20°W. This produced a strong northwest-to-southeast gradient between Kap Farvel and the Azores (fig. 36).

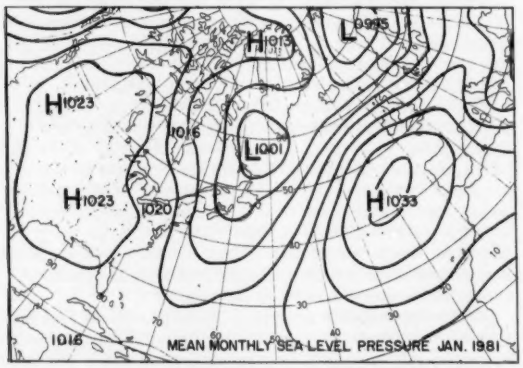


Figure 36.--Mean sea-level pressure, January 1981.

The North Atlantic was dominated by a large plus 18-mb anomaly centered near 48°N, 19°W. Positive values covered the area east of 50°W and south of Iceland to 15°N and Europe except Scandinavia. There was a weak minus 5-mb anomaly that covered eastern Canada and southward over Nova Scotia.

In the upper air there was a major sharp trough off the East Coast. Both the upwind and downwind ridges were much sharper than normal. This brought more northeasterly flow over the major shipping lanes.

Extratropical Cyclones--The first severe storm to form this month was discovered near Cape Hatteras on the 0000 chart of the 2d. The CHEVRON KENTUCKY (39°N, 60°W) reported 48-kn southerly winds at 1800. On the 3d several vessels found winds near 50 kn. The CANADIAN CJR6 reported 55-kn winds twice near 44°N, 59.5°W. At 1200 the seas were 20 ft and swells were 34 ft. The LOW was 972 mb over the Strait of Belle Isle. There were winds up to 60 kn early on the 4th and 74 kn at 1200. They were reported by the Canadian ships ALGOSEA (48°N, 63°W) and the VOBJ (48°N, 50°W). For some reason they were not reporting waves. On the 5th the LOW was over the Labrador Sea. A deepening frontal wave was traveling northward over Newfoundland and absorbed the circulation late in the day. It brought strong gales to the Grand Banks. The GEORGE WYTHE had 45-kn winds west of the front near 40°N, 61°W. Later, another ship had thunderstorms with 20-ft waves at the cold front.

This storm came out of the northern plains of Canada west of Hudson Bay. On the 7th it was north of Lake Ontario and its southerly winds were offshore. At 1800 the E. HORNSBY WASSON was east of Norfolk with measured 54-kn winds and 33-ft swells, which increased to 39 ft 6 hr later, while the winds decreased to 25 kn. On the 8th there were some strong winds ahead of the cold front. A ship (36°N, 67°W) had 45 kn with 25-ft waves. At 0600 the CGYM had 68-kn southeasterly winds at 47°N, 59°W. The storm was now tra-

veling a path similar to the prior storm, but lucky for any ships near Labrador, it was farther inland. At 1200 the storm was 973 mb at 51°N, 65°W. There were 50- to 60-kn wind reports south of Newfoundland at 1800. On the 9th a ship off Hamilton Inlet had 23-ft seas, and the MEERKATZE near Sondre Stromfjord had 58-kn southerly winds driving 20-ft seas. The storm continued northward and dissipated on the 10th near Baffin Island.

As the storm above moved over the Davis Strait, the front broke off over Greenland on the 10th and continued eastward. A ship near 62°N, 31°W, reported 50-kn winds east of the front. On the 11th an Icelandic ship near 63°N, 16°W, had 52-kn winds. A new low center had formed near Scoresby Sound. By 0000 on the 12th it was 960 mb near 72°N, 14°E. Ships and platforms on the North and Norwegian Seas were being hit by 45- to 55-kn northwesterly winds with 20-ft seas. The ESSO WARWICKSHIRE (61°N, 02°W) had 59-kn winds in subfreezing temperature. The storm moved across Nordkapp on the 13th as another storm center roared across Iceland.

As a deep LOW moved northward over northern Quebec, a small circulation was identified off Hatteras using buoy and ship reports on the 0000 chart of the 12th. By 0000 on the 13th the HOEGH TRIGGER was measuring 55-kn winds and 23-ft waves near 39°N, 67°W. A ship in the warm sector (35°N, 50°W) found 25-ft waves. The BUILDER (35°N, 59°W) found 45-kn winds and 25-ft waves on the 14th, and 50-kn winds with 20-ft waves on the 15th.

At 1200 on the 14th the 995-mb storm was near Anticosti Island and another low center had formed northeast of St. John's. By 1200 on the 15th the new center was the only circulation.

This was another of those storms that generate on the southeast coast of Greenland when a storm moves northward through the Davis Strait. At 1200 on the 13th the LOW was over Iceland. Ocean Weather Station Lima measured 40-kn winds and 20-ft waves in the warm sector. Twenty-four hours later the storm was 958 mb near Molde, Norway. Lima now had 50-kn winds and 30-ft waves. At 1800 a platform near 56°N, 03°E, measured 60-kn winds. On the 15th there were many reports of winds of 45 to 60 kn in the North Sea area with waves up to 33 ft. At 1800 one RIGG at 60.7°N, 01.7°E, reported the winds as 85 kn with 34-ft waves, and another at 60.5°N, 02°E, called the winds 50 kn and the waves 43 ft. The high winds and waves continued into the 16th, but by afternoon had decreased to reasonable values.

As the front from the storm described above moved south of the Alps, a LOW formed late on the 15th over the Adriatic Sea. Strong northwesterly winds were blowing off France and Spain and southwesterly winds south of Italy. A French ship south of Greece reported 70-kn winds. The NORDPOL off the south coast of Sicily radioed the winds as being 54 kn and the seas 16 ft. At 1200 on the 16th the LOW was 980 mb at 40°N, 20°E. Two ships reported 54-kn winds north of Libya. On the 17th the TOKIO EXPRESS (35°N, 21°E) had 50-kn winds with 23-ft waves. On the 18th the weakening storm was over Turkey.

North winds over 50 kn lashed southern Italy with rain and snow. Trees and walls were toppled. Pounding surf inundated villages in northeast Sicily. Powerlines and pylons were downed. Ships dragged anchor and broke moorings. Several sank. Among those involved were the EKTON and OCEAN FRIEND, CHEMICAL CHALLENGER, and RIVA 1. The GOLDEN PRINCESS sank at Perama and the DENIZ SONMEZ sank off Crete.

This storm had a cold origin near Lake Winnipeg. By 1200 on the 15th it was over Norfolk, Va. As it moved northeastward over the Gulf Stream, it intensified but had little affect on shipping except for gales until the 17th. The AMERICAN ALLIANCE (36°N, 68°W) had 50-kn winds. At 1200 on the 18th the 972-mb storm was near 60°N, 18°W, and relatively small; only about 1,000 mi in diameter. As it passed north of OWS Lima she had 65-kn winds, 26-ft seas, and 33-ft swells. At 1800 the winds had decreased to 45 kn, but the waves were still 31 ft. The DISKO (59°N, 15°W) and the GARBETA (57°N, 11°W) now had 60-kn winds with 33-ft waves. The storm was blasting the North Sea on the 19th with winds over 60 kn and waves over 35 ft. The DISKO was traveling east with the storm and had 68-kn winds and 59-ft waves at 0600 near 59°N, 13°W. On the 20th the storm was headed northward and quickly weakening.

On the 0000 chart of the 17th there was a flat trough off the U.S. East Coast. By 1200 a LOW had formed east of Long Island. The AMERICAN ALLIANCE was now in this storm with 50-kn winds and 33-ft seas. By 0000 on the 19th the U.S. ship NANT reported 72-kn winds from the northwest southeast of Cape Cod. Later three Canadian ships had 45- to 52-kn winds south of Newfoundland. Ships were finding 20-ft waves as far as 1,000 mi south of the center. A ship found 61-kn winds at 47°N, 48°W, at 2100.

At 1200 on the 19th the 960-mb storm was centered east of Belle Isle. Seven ships east of Cape Race radioed winds higher than 44 kn. The MARSEILLE had 56-kn winds and 49-ft waves near 45°N, 37°W, east of the cold front. The AMERICAN ALLIANCE was right at the front (45°N, 40°W) but the winds had shifted out of the south with 45 kn and 26-ft waves. Several ships reported waves up to 33 ft. On the 20th the CG11 had 65 kn near Sydney.

On the 20th the storm switched centers. The new 954-mb center moved northward over the Labrador Sea. A ship near the cold front had 50-kn winds and OWS Charlie had 21-ft waves. There were several 20-ft or higher wave reports in the southwest flow. On the 21st this low turned southeastward as another center moved northeastward from the southwest and generated 33-ft waves near its center.

As a LOW moved across the southern Norwegian Sea on the 19th, a LOW formed over Denmark. After the front crossed the Alps on the 20th another LOW formed over the Ligurian Sea. The VENDEE was west of Corsica with 55-kn winds and 25-ft swells. Two other ships nearby had winds near 50 kn with 18-ft seas.

At 1200 on the 21st the storm was 976 mb near 36°N, 17°E. There were 40-kn winds on the coast of Libya. On the 22d there were 45- to 60-kn winds with waves up to 34 ft between 10°E and 25°E. A SHIP at

Figure 37.--The ferry UNCATENA was stuck in ice off Nantucket on the 13th. The Coast Guard tug YANKTON could not break a path around the vessel. An icebreaker 3 mi away was struggling toward the stalled vessels, breaking a channel to allow a barge of oil to reach the island. Wide World Photo.

41°N, 11°E, reported 61 kn. The KARAGANDA (38°N, 10°E) reported 33-ft swell waves. Another SHIP near 36°N, 16°E, reported 48-kn winds and 34-ft seas. Bari on the northeast coast of Italy measured 40-kn winds as the strong winds over Libya moved to Tobruk.

The storm weakened slightly on the 23d and 24th, but land stations still measured 40-kn winds. On the 25th the spent storm moved eastward along Turkey's south coast.

The GUUL VICTORY lost tow of the IBIS BARGE off Malta on the 21st and it grouded at St. Julian's Bay. The APOSTOLOS M.I. took water in hatches south of Sicily on the 22d. The TARA sustained damage during voyage off Greece 22d to 25th. Also, the NANO K. grounded off Greece on the 25th.

The southern tip of Italy and Sicily suffered heavy damage with winds over 50 kn. Gales and blizzards raged for 36 hr. Buildings were damaged, villages isolated, and shore installations damaged. The earthquake victims near Naples were hit hard by the cold, snow, and high winds. Tents and trailers were blown over. Electricity and water was out in many areas.

Greece was hit by gale-force winds and ports were closed to small vessels. Cold temperatures with rain and snow disrupted communications and travel.

A weak LOW was found south of Lake Superior on the 28th. It was still weak as it moved over Long Island on the 29th, but strengthened in the next 24 hr over the warmer water. It was moving around the southern periphery of a LOW south of Kap Farvel that was producing gales and 20-ft seas. The TEXACO MASSACHUSETTS south of Cape Sable found 48-kn winds. The FEDERAL RHINE 200 mi south of the center had 50-kn winds. By 1200 on the 31st the 984-mb storm had sped to 52°N, 40°W. Several ships had winds near 50 kn. The ZIM MONTREAL (44°N, 39°W) had 55-kn winds. The storm moved northward, west of OWS Charlie, and on February 1 had 45-kn winds with 23-ft seas. The storm moved over Iceland on the 2d. At this time it was producing only gales with an isolated strong gale according to the reports on radio. Ships south of Iceland were reporting waves up to 23 ft. On the 4th the storm moved over Norway and out of the area of primary interest.

Casualties--There were reports that the following ships suffered heavy weather damage: ANNA, DIONE, ENGEDI, GELINDA, HALCYON MED, JUNIOR K., KADERBAKSH, MEDITERRANEAN SUN, MOLISTA, NASEEM, OGUY, ROSINA TOPIC, SAUDI CROWN, SOCA, and THEOTOKUS. The following ships collided in fog: BLACKTHORN and FREDERIKA 1 at Greenwich Reach, FLANDRE and APRICITY at River Scheldt, INSELSBERG and JAGAT KIRTL at Schulp, LUBECA and VOLGO-BALT in Kiel Canal, and SAINT GERMAIN contacted a pier at Dover. The TEMSE grounded in the River Scheldt in poor visibility on the 28th. The RIMBA MERANTI sustained propeller blade damage in ice off Finland. The IBN SIRAJ had ice damage to the propeller in the St. Lawrence River. The BUNGA CHEMPAKA had ice damage near Montreal. The WORLD

KINDNESS sustained ice damage at Quebec. The Panamanian freighter (8,767 tons) DUTEOUS knocked over two cranes at Montreal when she was pushed into a pier by massive ice floes in the river.

The FJALLFOSS sent a Mayday on the 3d about 130 mi west of Faroe Islands after taking on water in force 8 to 9 winds. The NOBLE FIVE reported heavy weather in the Mediterranean Sea from the 3d to the 7th. The RAYES grounded in the Gulf of Asinara on the 6th in bad weather. The TIMGARD developed a list when timber cargo shifted in bad weather off Bornholm on the 8th. The GRIGORIOS C. IV and VRANCEA contacted at Alexandria while at anchor. The ORAN and VENCEMOS dragged anchors in high winds in Cristobal on the 13th. The ferry UNCATENA became stuck in ice 2 ft thick off Nantucket, Mass, on the 13th (fig. 37). The Coast Guard tug YANKTON came to her aid, but an icebreaker had to be called to free both of them.

The ALGOL grounded off Turku, Finland, on the 16th. The crew was rescued one by one by helicopter in force 10 winds and a snowstorm. The ABED AL SALEM had containers break loose in bad weather off Crete. The EVANGELISTRIA V ran aground and was abandoned by her crew on the 19th near Oristano. The IBIS BARGE parted from tow of the GUUL VICTORY off Malta on the 21st. The APOSTOLOS M.I. took water in rough seas near Malta on the 22d.

The 70,341-ton Greek bulkcarrier DEIFOVOS sank off the Norwegian coast in heavy weather on the 25th that included 33-ft seas and a blizzard. One hatch cover had been torn off. She was carrying 66,000 tons of iron ore and developed a 20-degree list--a half-hour later it was 45 degrees. Helicopters rescued 29 survivors with 5 dead and 4 missing.

The ANASTASIA encountered bad weather in the Aegean Sea with heavy pitching and rolling on the 27th and 28th. The ANDREAS N. HADJIKYRIAKOS and the UNIQUE CHALLENGE contacted in heavy weather at Alexandria on the 30th. On the 31st the SUNWAVE and PERRYVILLE had a collision in fog off the Bolivar Peninsula.

Four crewmen died when the 5,400-ton EMS and 2,168-ton UNDINE collided in fog off the Norfolk coast on the 30th. Two people were injured and 17 were rescued by 3 vessels.

Some late casualties. All except one were in the Mediterranean. The 15th, 16th, and 17th were also bad days for the 944-ton GOODWILL at 44.5°N, 08.2°E, the GERMAINE, R.E. (2,746 tons) off the coast at Mandoudhi, and the 524-ton FOURAT STAR near Limassol. The 13,692-ton ZEPHYR struck rocks in Bilboa outer harbor on the 13th and ran out of wind.

An alphabetical list of other weather-related casualties: ALEXANDER K., ASIA RINDO, CYCLOPS, DON MANUEL, ELK, GRETE STEVNS, HANNAH SPEARING, HENRY R. II, KIMOLIAKI PISTIS, KIMOLOS, MARITSA, MBANDAKA, QURMI, RANGAMATI, REEM B., SILVEREAGLE, and SULTAN DEDE.

The KINPURNIE UNIVERSAL reported a 3.8-m crack from heavy weather on the 18th at Durban.

SMOOTH LOG, FEBRUARY 1981--There was no primary storm path this month. Most storms had an overall northeasterly orientation, but they were spread out from the central United States to Europe. There were several cyclones over the Mediterranean, and these had an easterly orientation. Climatology indicates two primary tracks: one from the Great Lakes to Nova Scotia then northward, where it split south of Kap Farvel; the other from the Carolina coast northeastward toward Iceland and again splitting, one branch west of the Island and the other south.

The monthly mean sea-level pressure pattern was vastly different from climatology. The Icelandic Low was 996 mb near Keflavik, about 500 mi northeast of its normal 997-mb position. The Azores High dominated the ocean south of 50°N, extending much deeper into Europe and the United States than normal. There were two 1025-mb centers--one off Cape Race and the other at the normal location over the Azores (fig. 38).

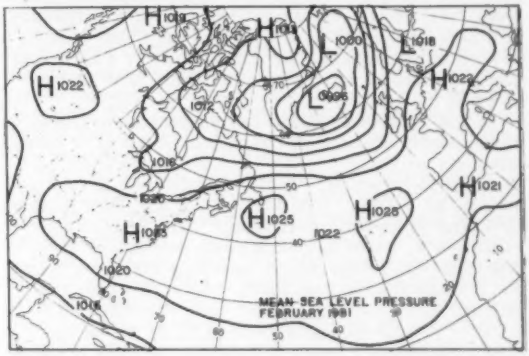


Figure 38.--Mean sea-level pressure, February 1981.

The displacement of centers produced two major anomaly centers. The negative one was 10 mb near Keflavik. A positive 15-mb center was east of Cape Race and was the much larger of the two. The zero departure isoline roughly paralleled latitude 20°N on the south and on the north followed a curve from Lake Huron to Cape Chidley to Kap Farvel to Rockall Bank to Nordkapp.

In the upper air at 700 mb the low center was 240 m lower than normal over Devon Island. The longwave trough was retrograded from the U.S. East Coast to west of the Appalachian Mountains. There was an anomalous trough west of Europe with the usual ridge pushed eastward over the continent.

Extratropical Cyclones--On the fifth day of the month a large 1040-mb HIGH was centered near 42°N, 25°W. A LOW was traveling northward over the Labrador Sea and, as happens many times, another LOW popped up over the Denmark Strait area. Ocean Weather Station Charlie had 40-kn winds with 20-ft seas east of the front. By 1200 on the 6th the LOW was 944-mb near 70°N, 01°W. The pressure had plunged 27 mb in 24 hr. The C.P. DISCOVERER was west of the Outer Hebrides with 58-kn west winds, 23-ft seas, and 33-ft swells. The MULAFOSS was south of Iceland with 60-kn winds. By 0000 on the 7th the storm had dropped 4 more mb to 940 mb, a very deep storm. Gales of 40 kn were blowing at the Island stations and North Sea ships and platforms were measuring winds over 50 kn with waves up to 30 ft.

A frontal wave imbedded in the zonal flow raced across the Faeroe Islands late on the 7th. OWS Lima had 48-kn winds and 28-ft seas. There were six ob-

servations of winds greater than 60 kn and four observations of waves of 39 ft in the area of 60°N, 01°E. Two within 65 mi of each other had 75-kn winds at 0600 on the 8th. The jack-up drilling platform DIRK broke loose in the northern Kattegat. Tugs finally got the rig under control only 2 mi from the coast. Another drilling platform, the new hull no. 11, got in trouble 20 mi west of Kvitsoy. The tow was cut, but later re-established when the sea moderated 13 mi from Kvitsoy. On the 9th the original LOW was weakening over Nordkapp and the frontal wave was deep into the U.S.S.R.

A frontal wave from the Gulf of Mexico crossed Jacksonville, Fla., late on the 7th. It moved up the U.S. East Coast and late on the 8th absorbed the circulation of a LOW moving eastward north of the Great Lakes. Several ships including the IMPERIAL ST. CLAIR had winds between 45 and 50 kn on the 9th. SEDCO had 49 kn on the 10th.

On the 11th the storm center slammed into Ivigtut on the southwest coast of Greenland, and a LOW broke off on the southeast coast. The CRYOS (51°N, 51°W) reported 60-kn winds. The circulation now spread as far east as Ireland. The AMERICAN ALLIANCE (48°N, 32°W) had 50 kn with 28-ft swells. The OSLO VENTURE (46°N, 38°W) had 38-ft swell waves. By 1800 CHARLIE was measuring 48-kn winds with 33-ft seas that increased to 39 ft at 2100. The PIONEER CONTENDER also had 33-ft waves. The NECHES had 30-ft waves with 50-kn winds near 43°N, 23°W, on the 12th. There was a large 1056-mb HIGH slightly southeast of Cape Race at 1200 on the 11th. Late on the 12th the LOW and HIGH both had started to weaken, but there were still winds as high as 50 kn in the northwest flow and the PIONEER CONTENDER was fighting 42-ft swells at 1200 near 46°N, 25°W.

This storm raced out of the southwestern United States. It moved across Lake Huron on the 11th, already a powerful storm, but only its outer reaches were off the east coast. It crossed Ungava Bay on the 12th. High pressure was following the storm on a northeastward track. At 1200 on the 13th the 960-mb low center was near 70°N, 58°W. The 1053-mb HIGH was centered near Portland, Maine. This was a 93-mb pressure spread over about 1,700 mi. This was an average pressure gradient of about 5.5 mb per 100 mi. There were no ship reports of high winds over the Labrador Sea, but it was probably because there were few or none present. Several northeastern U.S. cities reported all-time record pressure readings. Those that were included in the above 31.00 in of mercury club were Washington, D.C. (31.02); Hartford, Conn. (31.03); Allentown, Pa. (31.03); and Philadelphia, Pa. (31.05). The HIGH moved offshore and weakened as the storm weakened over Baffin Bay.

As the high pressure above moved offshore, a frontal wave formed south of the HIGH on the old front originally associated with the deep LOW. At 1200 on the 15th the GEORGE OUSHAKOV was analyzed as being within 2 mb of the 1005-mb storm center near 44°N, 44°W, with 45-kn winds and 18-ft seas. Early on the 16th the BRITISH MAPLE near 63°N, 20°W, had 45-kn winds with 33-ft swells, while the TUNGUFOSS at 60°N, 07°W, called the winds 58 kn.

By 1800 on the 16th two Icelandic ships reported winds above 59 kn. By 0000 on the 17th there were five reports above 58 kn. None were reporting wave heights. The highest wind of 68 kn was reported by the ARNI FRIDRIKSSON, HOFSJOKULL, and the TFXK, all in the vicinity of 64°N, 22°W.

A newspaper item from Reykjavik reported winds over 100 kn hit the Island on the 16th and 17th. The fishing vessel HEIMAEY caught a net in her propeller. She broke loose while being towed and drifted ashore on on the south coast. Two men were swept overboard. At this time the 956-mb LOW was over northwestern Iceland. By the 18th the storm was north of latitude 80°N.

On the 17th a front stretched southward from the Greenland coast past Ireland to off Portugal, where it curved southwestward. On the 1200 chart "ship reports" indicated the formation of a wave between and south of two high centers. By 1200 on the 18th there was a very distinct surface and upper air cutoff LOW. The ANTONIA JOHNSON (28°N, 46°W) was caught in it with 33-ft waves. The storm was inching northeastward and slowly deepening plus widening its influence. On the 20th the TFL EXPRESS was in the northern fringe with 45-kn winds.

There was high pressure north of the storm and the tightest gradient was in that sector. The AMERICAN ARGOSY found 60-kn winds (44°N, 43°W) out of the northeast with 44-ft swell waves on the 21st. The TFL EXPRESS nearby measured 55 kn with 25-ft waves. The storm was making a counterclockwise loop near 40°N, 40°W.

Another LOW was traveling southeastward from the Delaware Bay on the 24th. On the 25th the two upper air circulations combined, which signaled the end of this storm.

A LOW formed off Cape Cod late on the 25th. The center moved southeastward, and a U.S. ship near 30°N, 59°W, reported 50-kn winds and the GYPSUM EMPRESS (43°N, 70°W) had 25-ft swells out of the northwest. At 1200 the OLEANDER had 50-kn winds with 20-ft waves about 160 mi southwest of the center. On the 27th the FRAUENFELS (33°N, 59°W), 300 mi south of the 978-mb center and sailing northward, had 52-kn winds with 33-ft westerly swell waves. Other ships were reporting gales and waves up to 28 ft.

The storm was now on a northeasterly track. The AMERICAN LEGEND (36°N, 62°W) found 48-kn winds at 1200 on the 28th. On March 1 other low centers moved into the circulation and on the 2d this storm was gone.

A LOW crossed the Davis Strait and moved onto the Ice Cap where it vanished. On the next chart on the 22d, a new LOW was found over the Denmark Strait. It remained stationary west of Iceland for the next 84 hr with a few gales reported now and then. It appeared that on the 26th some colder air was advected south of the upper air LOW and it started moving southeastward. There was a large stationary 1052-mb HIGH east of Leningrad and the eastern gradient tightened.

The CAUCASUS MARU (57°N, 15°W) had 50-kn southerly winds and 30-ft seas at 1200, and the ADRIATIK had 60-kn southeasterly winds and 23-ft seas

near 51°N, 13°W, at 1800 on the 26th. There were winds above 50 kn around the British Isles on the 27th.

At 0000 on the 28th the 976-mb LOW was near 53°N, 19°W. The OVERSEAS MARILYN (49°N, 21°W) measured 60-kn westerly winds and 49-ft waves. The CAUCASUS MARU was now west of the center with 45-kn winds, 30-ft seas, and 33-ft swells. The LOW was about to absorb another that had moved into the area from the southwest. An observer on the North Sea reported 58 kn and 33-ft waves. At 1200 a platform near 58°N, 0.1°E, reported the winds as 130° at 70 kn with 39-ft seas. There were several reports of waves up to 25 ft. The high winds and waves reported on the northern North Sea continued into March 1. The OSTROV BERINGA was 500 mi southwest of the center of the storm with 64-kn winds. As the storm moved across Ireland and Wales it lost its punch.

The 28,000-ton icebreaking bulkcarrier M.V. ARCTIC began a test voyage across Lake Melville in Labrador. The test was not only to measure the performance of the ship under severe ice conditions but to determine if commercial shipping on the lake is feasible year-round. A similar voyage was made by the Coast Guard icebreaker FRANKLIN last year.

Casualties--The following vessels had problems with ice this month: AFRICAN VIOLET, CAST BEAVER, GOLDEN ENDEAVOR, and ZENKO MARU. The Swedish SEFIR was in distress at Olands Sodra Grund on the 20th due to weather and icing. The crew was rescued, but the vessel apparently sank. The first day of the month began with a collision in fog in the English Channel between the ACTIUM and the HANNAH SPEARING. The Greek tanker AIKATERINI had a fire in the engineroom area on the 1st while 8 mi off Cape Henry, Va. The 36 crewmembers were evacuated. Fire-fighting efforts were hampered by 60-kn winds and high seas. The AMERICA, U.S. destroyer RADFORD, and Coast Guard cutter UNIMAK were on the scene. On the 10th the SOUNION and FEDDY collided in fog off Algiers. This was because of poor visibility but not from fog but a sandstorm. The OCEAN ENVOYdamaged her rudder while avoiding contacting the vessel ahead in the sandstorm in the Suez Canal.

High winds caused these casualties. The CONTRACT TRADER and MARRA collided, the ERODONA was pushed aground, and the MARIAJOSE T. broke her moorings.

These vessels specified heavy weather as the culprit. The JARAMAC 33 sank off Dubai. The VERONA ran aground near Cap Bon, and the OGDEN NELSON had damage to the port anchor on the 5th. The Argentine LA PAMPA arrived Bilboa with damage to the deck and lifeboats plus one container loaded with whiskey washed overboard. The condition of the crew was not stated. The EASTERN ENERGY was anchored off Sardenia until weather abated on the 6th. The Greek TENIA II sank in heavy seas off the island of Skyros on the 8th and it was feared the five crewmembers had drowned. The Liberian OPAL became disabled in the Bay of Fundy. While being towed on the 12th the towline parted and she drifted aground.

The Greek TOXOTIS sustained rudder damage on the 12th enroute to Rotterdam. The towboat GALVESTON sank off the Texas coast in bad weather. Only the master was rescued. The 5,564-ton EASTERN MARINER sank off Bermuda on the 18th after sustaining hull damage in heavy weather on the 14th. The LAGO LANALHUE sustained weather damage while on a voyage from Peru to Italy, January 30 to February 17. The Canadian tanker WITSUPPLY sank off Cabo de la Vela on the 17th enroute to Cartagena. The bulkcarrier OLIVIA encountered heavy weather on the 19th on a voyage from South American ports to New York.

The FAST ONE, FIDIAS, and JAMIL had weather damage on the 22d and 23d in the Mediterranean. The CHITRAL encountered heavy weather on the 22d south of the Azores. The American-registered CALIFORNIA had damage on the 25th on a voyage from Lisbon to Tampa.

Smooth Log, North Pacific Weather

January and February 1981

SMOOTH LOG, JANUARY 1981--The envelope of the majority of the storm tracks this month resembled a horn of plenty with the small end near Japan and the large open end near the Alaska Peninsula. This followed the major storm paths as indicated by climatology. A major climatic path from east of Japan northward into the western Bering Sea was barely represented. Storms originating north of Hawaii quickly turned northward into the Gulf of Alaska. A few storms paralleled or crossed the North American coast.

The Aleutian Low was 985 mb near 50°N, 170°W, which was 12 mb deeper and 900 mi to the east of its climatic counterpart. The Pacific High was near normal off Baja California. This made the Aleutian Low the dominant feature of the mean-pressure chart, exerting its influence from latitude 25°N to 75°N, and between the Asian and the North American coasts (fig. 39).

The only significant anomaly was a large negative

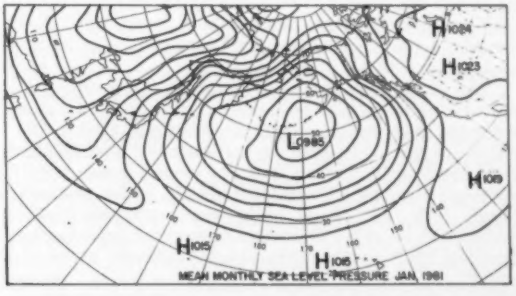


Figure 39.--Mean sea-level pressure, January 1981.

one that basically covered the same area as the Aleutian Low. Its large central area contained three centers: minus 20 mb near Cape Romanzof, minus 19 mb

near Unimak Pass, and minus 17 mb near 47°N, 150°W. The anomaly pattern was ridged over the Rocky Mountains as in the pressure and height patterns.

The upper air pattern was shifted eastward. The normal closed Low over the northern tip of Sakhalin Island was shifted to the north central Bering Sea (60°N, 180°). The upper wind flow was zonal until about 160°W, where it shifted northeastward and northward. The ridge over western North America was sharper and also shifted eastward. There were two anomalies that influenced the weather, or the weather that produced the anomalies, a large negative one over the north central ocean and a large positive one centered over the northern Canadian Plains.

Extratropical Cyclones--Monster of the Month, North Pacific--This storm formed on the east coast of Honshu as another LOW was over the Sea of Japan. The GOLDEN PINE sank after reporting taking water in No. 1 and 2 holds on the 2d, west of Shikoku. None of the crew of 25 were found. The storm moved rapidly eastward and by 0000 on the 4th was near 45°N, 168°E. The bulkcarrier ANTIPAROS with a crew of 35 and laden with 21,000 tons of iron scrap sank sometime after the 3d. She had radioed her agent that she was in difficulties in heavy seas. Her position on the 2d was 33°N, 154°E. No trace was found.

Another center was following this one and elongating the total circulation. Southeast of the LOW near the top of the ridge a ship had 33-ft swells. A ship near the cold front in the warm sector had 30-ft swells. Another in the northeast flow had 25-ft swells. The higher winds were 45 to 50 kn and south of the centers.

On the 5th the original LOW was moving northeastward and the second LOW swinging around the southern edge. The COLUMBIA MARU (34°N, 172°E) had 50-kn winds. Some ships along 180° between 25° and 35°N had swells up to 30 ft.

The 0000 chart of the 6th showed a large cyclonic circulation with four low centers. Cyclonic curvature extended from Asia to North America and 25°N to the Arctic Ocean. The only exceptions were where ridges from the Pacific and Asian Highs extended into the southern corners. The SANKOGRAIN in the central ocean (38°N, 180°) found 50-kn winds with only 15-ft waves. Many ships scattered throughout the westerly flow had 20-ft swells. The MIKAWA MARU (50°N, 174°E) near the original LOW had 28-ft swells. On the 6th the original LOW disappeared. The second one turned northward, then northwestward across the Bering Sea. The large cyclonic circulation continued.

On the 8th the easternmost of the four LOWs moved into the Gulf of Alaska and brought high winds and waves to that area. Many ships had winds near 50 kn and the KEYSTONE ACE (50°N, 133°W) measured 60 kn and the CHEVRON WASHINGTON measured 41-ft swell waves near 46°N, 133°W. The tight gradient off the Alaska-British Columbia coast continued into the 11th as yet another LOW moved northeastward.

This was another of the LOWs associated with the large cyclonic circulation. It developed in a trough off Honshu. At 0000 on the 6th the storm was near 38°N, 154°E. The ERIKA BOLTEN was about 550 mi southwest of the center with 50-kn winds and 25-ft waves. The MEERDRECHT (29°N, 150°E) had light winds but 26-ft swells. By the 7th a second LOW had formed west of this one as in the previous storm system but on the opposite side. The GOLDEN ORCHID found 56-kn winds due south of this new storm. Thirty-foot waves were found by a French ship southeast of the first LOW near the cold front. On the 8th the ship had 34-ft seas. About 300 mi southwest of the original LOW a SHIP reported 33-ft waves and another 26-ft swells. There were several cases of waves over 20 ft. Two ships thousands of miles apart (149°E and 166°W) had 60-kn winds. The ZIM HONG KONG found 60-kn winds within 4 mb of the 970-mb storm on the 9th. The JAPAN ERICA had 55-kn winds and 26-ft swells 400 mi south of the center. The LOW stalled near 50°N, 173°W, on the 9th until it moved northward on the 11th and dissipated on the 12th.

Three small LOWs were drifting around the periphery of a LOW that was near Mys. Lopatka on the 11th. One of these became unstable and increased in size. On the 12th the LOW was 974 mb near 44°N, 179°W. The PRESIDENT KENNEDY and JUPITER 1 were both within a few miles of 42.5°N, 173°W, and reported winds of 45 kn with 20- and 25-ft waves on the 13th. The LOW was 960 mb near 47°N, 170°W, at the time. Three ships had 45- to 50-kn winds south of the storm on the 14th. The PRESIDENT KENNEDY was traveling eastward with the storm and had 50-kn winds with 33-ft waves on the 15th. Late that day the storm disappeared in a puff of sea spray.

The large cyclonic circulation still existed across the northern ocean but was not as strong and beginning to break down in the west. On the 13th a small depression was found near 37°N, 148°W. At 0000 on the 14th the 969-mb storm was moving northward. In the southwest sector the CGC IRONWOOD was sailing into gales with 30-ft swell waves. Not far away a German ship had 26-ft swells.

The pressure gradient had piled up against the coastal mountains from California to Alaska. The SHINKO MARU (46°N, 138°W) had 57-kn southerly winds. The ALEUTIAN DEVELOPER (54°N, 139°W) had 45-kn winds from the south. The isobars ran nearly directly north-south. The pressure at the two ships only disagreed by 1.7 mb. At 1800 the MOBIL MERIDIAN (53°N, 132°W) reported 78-kn winds stirring up waves of 33 ft. There were various gale reports on the 15th as the front crowded closer to shore. The LOW moved over Anchorage as it traveled northwestward.

A LOW came out of Asia and was over the Korea Strait at 0000 on the 15th. It traveled eastward bringing only gales to those in its path. On the 18th the AMERICAN LIBERTY (38°N, 169°E) had 45-kn gales about 2° lati-

tude south of the center. Nearby the BLUE HAWK was having 23-ft waves.

On the 19th there was a switch of centers as another was found to the east on the 0000 analysis. At this time the weather of most concern was high waves with swells up to 46 ft as reported by the SINALOA near 28°N, 152°W. She measured 60-kn winds driving 33-ft seas. The BIRCHBANK and CHUEN ON also measured 60-kn winds in that general area but farther west. At 0000 on the 20th the SINALOA still howled about 46-ft swells. The ANTE TOPIC (41°N, 139°W) east-northeast of the 954-mb storm (39°N, 146°W) had 60-kn winds and 41-ft waves. The MAUI (29°N, 144°W) found 65-kn winds at 0600 with 65-ft waves. Waves of 20 to 30 ft were being reported in all quadrants except the northwest. At 1200 a SHIP at 29°N, 144°W, radioed a report of 49-ft swell waves. The POTOMAC off Portland, Oreg., on the outer fringes of the circulation called the winds 60 kn with 25-ft seas and 49-ft swells.

A listing of wind reports of 45 kn or greater by radio showed 15 reports around the storm. Four were of 60 kn, two in the northwest flow and two in the southeast flow. The Selected Gale and Wave Observations for the 21st had 37 reports by mail. The ORIENTAL MERCHANT (51°N, 146°W) appeared to be the closest to the storm center with a pressure of 966 mb (storm center 956 mb) and 48-kn northerly winds and 49-ft waves. The AMERICA SUN, ARCO JUNEAU, and MOBIL ARCTIC, in the vicinity of 52°N, 136°W, all had swell waves of 38 to 43 ft. On the 22d the PACSTAR (50°N, 147°W) called the winds 75 kn and the waves 33 ft. Others were reporting around 50 kn and 25- to 30-ft waves. Later in the day the storm broke up rapidly.

This storm was a series of LOWs. The instigator of the whole thing was an insignificant 1003-mb center first found on the 1200 chart of the 19th east of the Tsugaru Strait. By 0000 on the 22d the storm was 966 mb near 46°N, 175°W. In the meantime another small LOW had tracked eastward from Hokkaido. There was strong northwesterly flow between this LOW and a 1057-mb HIGH over central Asia. The PIONEER No. 1 found 50 kn off the east coast of Honshu. South of the primary LOW there were some 20- to 30-ft waves.

By 0000 on the 23d the storm had deepened further to 956 mb. Four ships had winds between 45 and 50 kn. The AMAZON MARU (47°N, 170°W) about 200 mi south of the storm's center had 26-ft waves. At 0300 the NATALIE BOLTEN was about 300 mi south of the second LOW with 64-kn winds and 43-ft swell waves. Later in the day another LOW formed east of the second LOW and sped northeastward. By the 24th the first two LOWs were weakening and new circulation was 960 mb. There were 20- to 25-ft waves in the westerly flow south of the centers. At 1800 the SEA-LAND DEVELOPER was off Queen Charlotte Sound with 54-kn winds from the southeast. She was sailing northwestward toward the storm and winds near 50 kn continued into the 26th. The storm moved up the west coast of Alaska into the Bering Strait.

This storm formed in a trough that extended southwestward over the Sea of Okhotsk to the La Perouse Strait on the 24th. The MARIA TOPIC found 55-kn winds near 34°N, 155°E, south of the frontal system at 0000 on the 25th, which increased to 60 kn at 0600 with 18-ft waves. On the 26th the 980-mb storm was east of the Kurile Islands, and another center had formed to the east. Several ships measured winds near 50 kn with waves near 20 ft. The SHUNWIND at 47°N, 156°E, measured 60 kn with 20-ft seas and 33-ft swells.

The initial LOW was drifting eastward very slowly while the eastern LOW moved northeastward. Another frontal wave south of the initial LOW was traveling eastward near 35°N on the 27th. The CHUEN ON (36°N, 155°E) now measured 60-kn winds, while the SHUNWIND had decreasing 52-kn winds, but increasing 46-ft swells. On the 28th the reported winds were generally below 50 kn and the waves below 20 ft.

The original LOW disappeared on the 29th, but the other cyclones that had formed still sustained some strong gales and 20-ft waves. On the 30th one of these entered the Gulf of Alaska. The ARCO ANCHORAGE measured 50-kn winds and MOBIL MERIDIAN had 33-ft waves. There were similar reports on the 31st, but the gradient was relaxing.

Casualties--The following vessels encountered heavy weather and suffered damage or requested surveys for damage this month. They were the AEGIS PRACTIC, AQUACHARM, CAPTAIN VENIAMIS, EASTPORT, GOLDEN KIMISIS, GOLDEN MIRANDA, HOPECLIPPER, and SEA TIGER.

The GOLDEN PINE sank off Shikoku after radioing that No. 1 and 2 holds were flooded in rough weather. Search craft found an oil slick, lifeboat, and rafts, but none of the crew of 25. The ANTI PAROS, with a crew of 35, sank off Japan on the 3d or 4th. She radioed that she was in trouble due to heavy seas. No trace was found.

The ferry KLAHOWYA and bulkcarrier SANKO-GRAIN collided in fog in Elliot Bay, near Seattle on the 13th. On the 15th the SEINE MARU collided with the COOP GRAIN in the same bay in fog.

Late casualties. The DELTA VENTURE suffered weather damage in the East China Sea on the 2d. The GOLDEN MIRANDA was at Nagoya on the 5th with weather damage. The PAPAGAYO UNIVERSAL had repairs in Vancouver for January damage. The barge ALSEA towed by the tug HENRY SR had cargo shifted in 40- to 50-ft swells and towline allegedly parted on the 19th in 55- to 60-kn winds and 35-ft swells. The barge was retrieved on the 20th, but it overturned near 30°N, 145°W. The barge was towed to Honolulu while capsized but dragged anchor in a gale on February 10 and grounded on a reef. The COSMOS CAPELLA encountered heavy weather on the 17th to 23d during passage from Dampier to Onohama. The FAIRWIND contacted the CAPTAIN NICOLAS while changing anchoring position in heavy weather off Yuzhnyy in the U.S.S.R. on the 29th.

Other Casualties--The STAR CENTAURUS arrived Australia with heavy weather damage. The tug BELLARINE, Westernport to Melbourne, encountered heavy weather on the 21st with damage. The NANCOCK, carrying supplies to Australia's Antarctic bases, damaged her rudder in an ice pack. The NAND KOYAL, Bombay for Colombo, arrived on the 13th with weather damage. The AL MUREJAN was driven ashore in high winds at Sharjah. Several vessels suffered damage at Semarang on the 7th and 8th. They were barges L39 and SML 1403, the salvage vessel SALVIKING, tug SALVALET, and the landing barge BINTANG SRIWIDJAJA.

SMOOTH LOG, FEBRUARY 1981--There were the usual or greater number of storms this month and they were well-behaved in that they followed a predictable path. Many formed over or east of Japan, taking an initial easterly path, then turning northeastward. Those from the vicinity of Hokkaido generally favored the Aleutian route, while those off Tokyo were routed in the Gulf of Alaska. Those that formed over midocean generally took the same route. A few storms formed off Washington State and moved onto the coast. All this generally was in good agreement with climatology.

The monthly mean pressure pattern was also in good agreement with climatology. The 993-mb Aleutian Low was 6 mb lower than normal near 48°N, 177°E, slightly southwest of its mean location. The Pacific High at 1021 mb was near its usual position (fig. 40).

The largest and most significant anomaly center was minus 9 mb centered near 44°N, 180°. Most of the ocean was negative, except near both coasts. There was a plus 3-mb center off Vancouver Island, which can be detected in the storm tracks.

In the upper air pattern the primary low center was near 50°N, 177°E, well east of its usual position. This affected the sharpness of the trough over the central ocean.

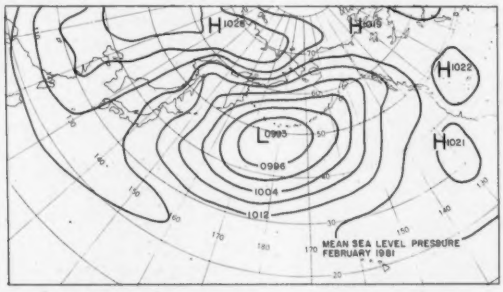


Figure 40.--Mean sea-level pressure, January 1981.

Extratropical Cyclones--A LOW with frontogenesis was found on the 1200 chart of the 3d just east of Tokyo. The storm was moving eastward. There were a few near gales, but at 1800 the Japanese ship JMLP found 58-kn southeasterly winds with 25-ft waves near 39°N, 163°E. The SANKOSTEEL measured 54-kn winds with 17-ft waves on the 4th southwest of the center. On the 5th there were several reports in the 45-kn range with one swell observation of 26 ft. On the 6th this storm invaded the southern part of the circulation of an older cyclone. Early in the day there were some strong gales and waves up to 25 ft 300 to 600 mi southwest of the LOW. The ALASKA COAST, JUDI B., and GALAXY, in the vicinity of the Aleutians, had 50- to 60-kn winds with gusts to 90 kn and waves to 18 ft. By the 7th this storm had absorbed the other center. There were some winds in the strong gale and storm categories with waves to 20 ft. The center was 972 mb north of Tanaga Island and on a northwest track. The storm dissipated on the 8th on the Siberian coast.

This storm formed south of Honshu on the 7th. On the 8th the OGDEN CONGO (37°N, 155°E) had 50-kn winds from the northwest. The EVER VALUE (33°N, 149°E) had 33-ft swell waves. By 0000 on the 9th the storm was 958 mb near 47°N, 168°E, and on a northerly track. This took the same type of track as the first one. There were many reports over 50 kn, including the PIKEBANK (45°N, 169°E) with 56-kn winds, 33-ft seas, and 46-ft swells. The WISTERIA (51°N, 167°E) reported 60 kn with 26-ft waves. At 1200 the NEW GOLDEN PHOENIX (48°N, 172°E) was east of the center with 76-kn winds and 23-ft waves. There were still some 50-kn winds early on the 10th, but later in the day the center was over Kamchatka and headed for oblivion. Far to the south that day the EVER VALUE (38°N, 167°E) found 40-ft swell waves.

On the 5th the Pacific High was off Seattle and there was a large area of very weak pressure gradient between it and Hawaii. On the 0000 chart of the 6th an observation from a SHIP indicated a weak LOW had formed. An old weak front moved into its circulation. It was associated with a weak cut-off LOW imbedded in a sharp southeasterly oriented upper air trough. On the 9th it was found that both the upper and sea-level LOWs had intensified. The tighter gradient was north through southwest of the center. A Japanese ship found 48-kn northerly winds with 23-ft waves. The GOLDEN FOREVER to the south near 32°N, 160°W, was involved with 30-ft swells. The AUSTRAL RAINBOW (32°N, 157°W) had 45-kn winds and 25-ft waves on the 9th. The FORTUNSTAR had 54-kn winds northwest of the 978-mb LOW. A ship closer to the center had 28-ft waves, and one south of the center had 26-ft swell waves. The SUGAR ISLANDER mailed in a report of 41-ft swell waves.

The storm was traveling northward and weakening. On the 12th there were two other LOWs southwest and southeast of this one, which died out on the 13th.

This potential storm had its birth near midocean (33°N, 175°W) late on the 9th. It traveled eastward with little consequence until it turned northeastward on the 12th. The ARILD MAERSK and PERENNIAL ACE both found 45-kn winds near 36°N, 138°W. By 1200 on the 13th the 972-mb storm was near 41°N, 140°W. The SAMUEL S. was east of the center and measured 64-kn winds from the south-southeast. Later in the day the SARGODHA measured 60 kn near 49°N, 136°W. The ALEUTIAN DEVELOPER found 55-kn winds near 52°N, 134°W, with 30-ft waves. The storm was dissipating on the 15th but the MOBIL MERIDIAN (57°N, 140°W) still found 33-ft swell waves.

The La Perouse Strait produced this storm. At 2300 on the 11th the SEATRAIN CHESAPEAKE (38°N, 158°E) made a special observation of measured 70-kn winds driving 38-ft seas. At 0500 she was measuring 50 kn with only 20-ft waves. At 0000 on the 12th the PAC-LADY (37°N, 157°E) was nearby with 52-kn winds. Other ships found gales and 20- to 25-ft waves. The storm was 976-mb by 1200 on the 13th near 40°N, 175°W. The TOYOTA MARU No. 16, SANTA BARBARA MARU, and AMELIA TOPIC had 45- to 55-kn winds and 30- to 43-ft waves in the area between 30° and 35°N and 170° to 175°E. The area expanded southward and eastward on the 14th.

The storm was traveling northeastward toward the Gulf of Alaska and the gradient was weakening. The only report of winds as high as 50 kn was from the

GOLDEN SABRE as a trough passed. The wind waves were 28 ft and the swell waves 36 ft. On the 16th another LOW was moving into the southwest sector, and yet another was moving into the eastern sector from the southwest. After 1200 the original LOW faded.

Monster of the Month--On the 16th there was a large, flat low-pressure area south of the eastern Aleutians. There were three weak LOWs just south of the islands and another moving around the southeastern periphery. The northeasterly winds through the islands were not especially high, but the air temperature was very cold, resulting in a lot of freezing spray. On the morning of the 17th the STORM PETROL, east of Unimak Island, reported heavy freezing spray during the night with all hands chipping. The JUSTINE FOSS nearby reported 35- to 45-kn winds, 8-ft seas, 22°F air and 39°F sea temperatures with moderate freezing spray and 3 in of ice on the superstructure. The morning of the 18th the NOAA ship MILLER FREEMAN reported snow with visibility as low as 1/4 mi, 25- to 30-kn winds, 10-ft waves, and moderate freezing spray north of Unalaska Island. At the same time the JUSTINE FOSS, now east of the Shumagen Islands had 6 in of ice on the superstructure. Their afternoon report did not mention ice. These reports were all received by WBH-29 Kodiak.

On the 16th there was a frontal wave over the East China Sea and another east of Hokkaido. By the 18th the western wave had caught the eastern one. The SHUNWIND and WESER EXPRESS had 55- and 60-kn winds with 30-ft waves near 35°N, 155°E. On the 19th at 0000 the LOW was 960 mb near 43°N, 178°E. The MARIA TOPIC (41°N, 174°E) had 60-kn winds and 20-ft waves. A ship near 39°N, 176°E, had 30-ft swell waves. By the 20th the storm's influence had reached the Gulf of Alaska, reinforcing the flow associated with a storm that had moved over the mountains. Winds of 40 to 50 kn were not uncommon and the EXXON SAN FRANCISCO found 41-ft seas near 48°N, 131°W. The storm moved ashore over the Kenai Peninsula on the 21st.

The warmer waters east of Kyushu produced the embryo of this storm on the 20th. On the 22d it was producing winds over 50 kn as attested to by the BELLMAN with 50-kn winds and waves up to 23 ft. At 0000 on the 23d the LOW was 960 mb near 47°N, 170°E. The MOSEL EXPRESS at 38°N, 156°E, had 63-kn northwesterly winds with 39-ft seas and the Japanese JLHD (39°N, 166°E) had 60 kn with swell waves of 49 ft. There were many reports of winds over 45 kn and waves over 25 ft. The AMERICAN AQUARIUS (37°N, 171°E) had 55-kn winds and 44-ft seas at 0600. The storm reached its lowest pressure of 956 mb at 1200. There were fewer observations by radio at that time and also on the 24th. Hopefully, the fewer radio reports of high winds meant ships were rerouting to avoid the more severe weather as the storm was still very powerful.

The storm center crossed into the Bering Sea near 180° on the 25th. It was shrinking in size and weakening. The PRESIDENT TAFT was south of Kodiak Island with 45-kn winds and 25-ft waves. The storm ended over Bristol Bay on the 26th.

This potential storm came out of the Sea of Japan on the 24th and raced eastward under zonal flow. At 0000 on the 26th the YOUNG SCOPE (40°N, 158°E) experienced 50-kn winds with 23-ft seas as the LOW raced north of them. By 1200 on the 27th the LOW was 966 mb north of Adak Island. On the 28th the DAWN at Hannah Rocks and the RUFF AND REDDY at Raspberry Strait had 50- to 60-kn winds. On March 1 the KOFUKU MARU near the Rat Islands had 55-kn winds with 26-ft waves. The JAPAN APOLLO found 48-kn southwesterly winds with 30-ft swells north of Adak Island on the 2d. The storm disappeared over the cold sea on the 3d.

Casualties--The GALLEON TOPAZ with a crew of 26 sent a distress signal because of stormy seas on the 3d while 1,615 mi south of Tokyo. She was feared sunk, but the Coast Guard in Honolulu found her later. The SEA TIGER requested a heavy weather damage survey on arrival in Japan. The AQUACHARM requested a weather damage survey on arrival in Japan on the 3d. The ALEGRIA DE PIO was due Tokyo on the 5th with heavy weather damage. The barge ALSEA, towed upside down to Honolulu dragged anchor in strong winds and grounded on the 10th. The barkentine CALIFORNIA ran aground in heavy fog off Point Loma, Calif. (fig. 41). All 54 passengers escaped without injury and some waded ashore.

The following ships requested heavy weather damage surveys for damage in February: SPECIALIST, AUSTRALIAN PROGRESS, CARA, AMELIA TOPIC, AEGIS FAME, JALAVIJAYA, and SEQUOIA.

The ZUIYO MARU capsized in rough seas in the Sea of Japan on the 17th. All eight crewmembers were missing. The PAPAGAYO UNIVERSAL drydocked in Vancouver for alleged weather damage between the 21st and 25th enroute to Seattle. The IZUMO MARU discharged weather damaged cargo at Guatemala on the 27th.

The ASTERION (16,112 tons) and JHELUM (5,922 tons) collided at Kagoshima when the latter dragged anchors. The KOMSOMOLETS NAKHADKI (4,054 tons) sank in stormy seas in Tsugaru Strait on the 26th. The MARSHAL ROKOSSOVSKIY picked up 18 crewmembers, but 15 were already dead, with 20 missing.

Figure 41.--A group of passengers waded safely to shore on Sunday, the 15th, after their whale-watching barkentine CALIFORNIA ran aground in fog off Point Loma near San Diego, Calif. Wide World Photo.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM REGULARLY.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

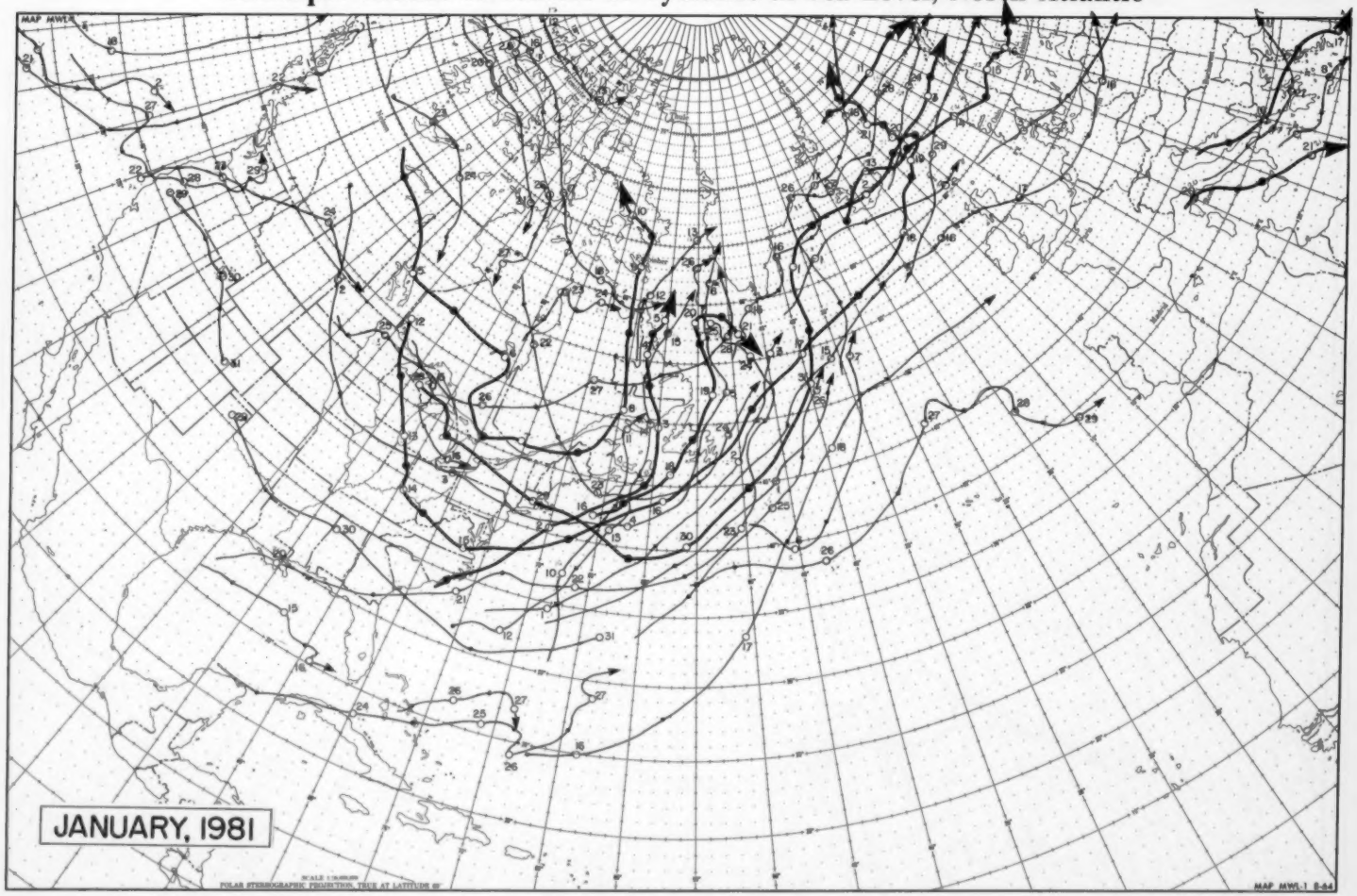


Figure 42. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

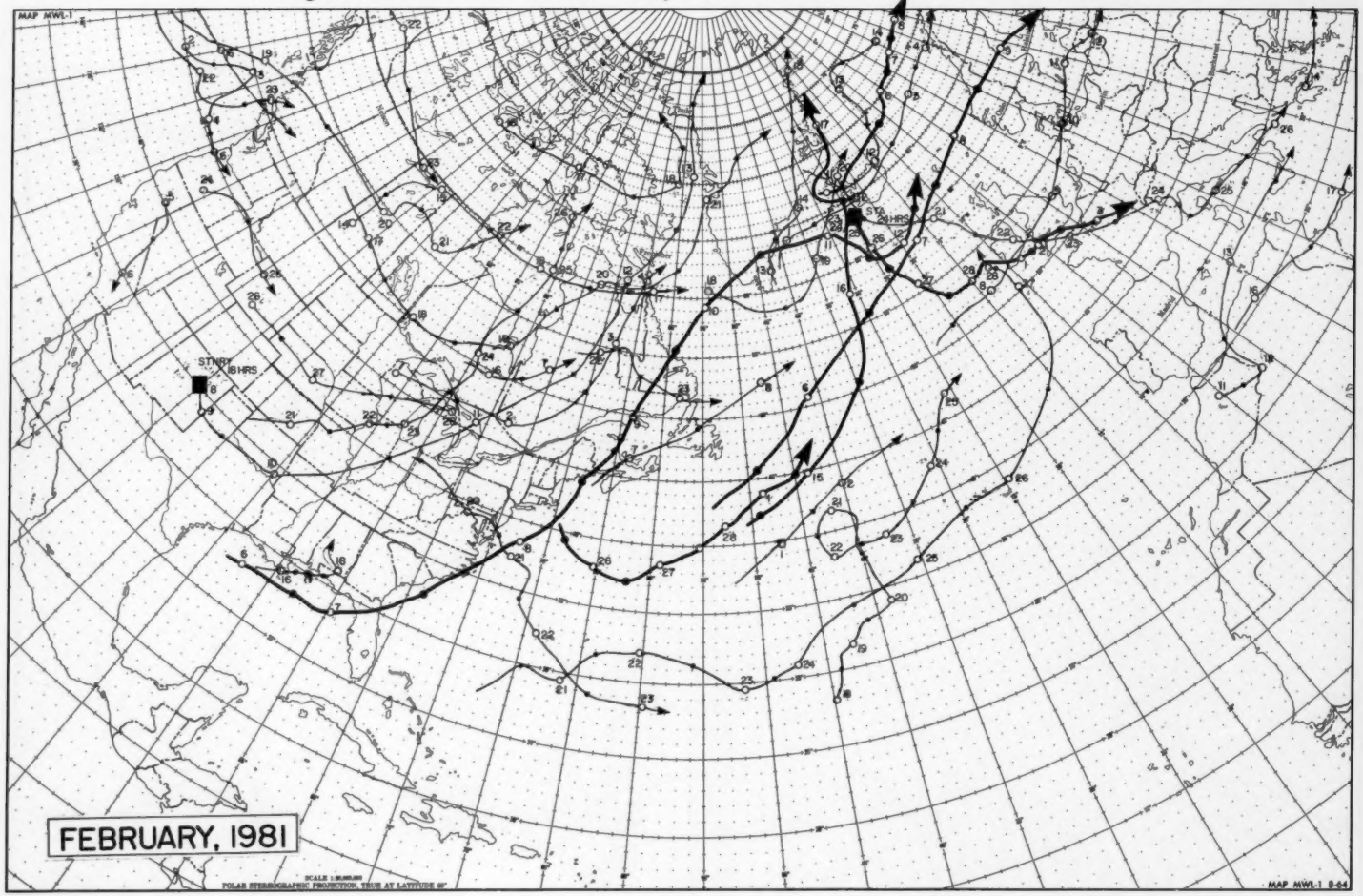


Figure 43. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

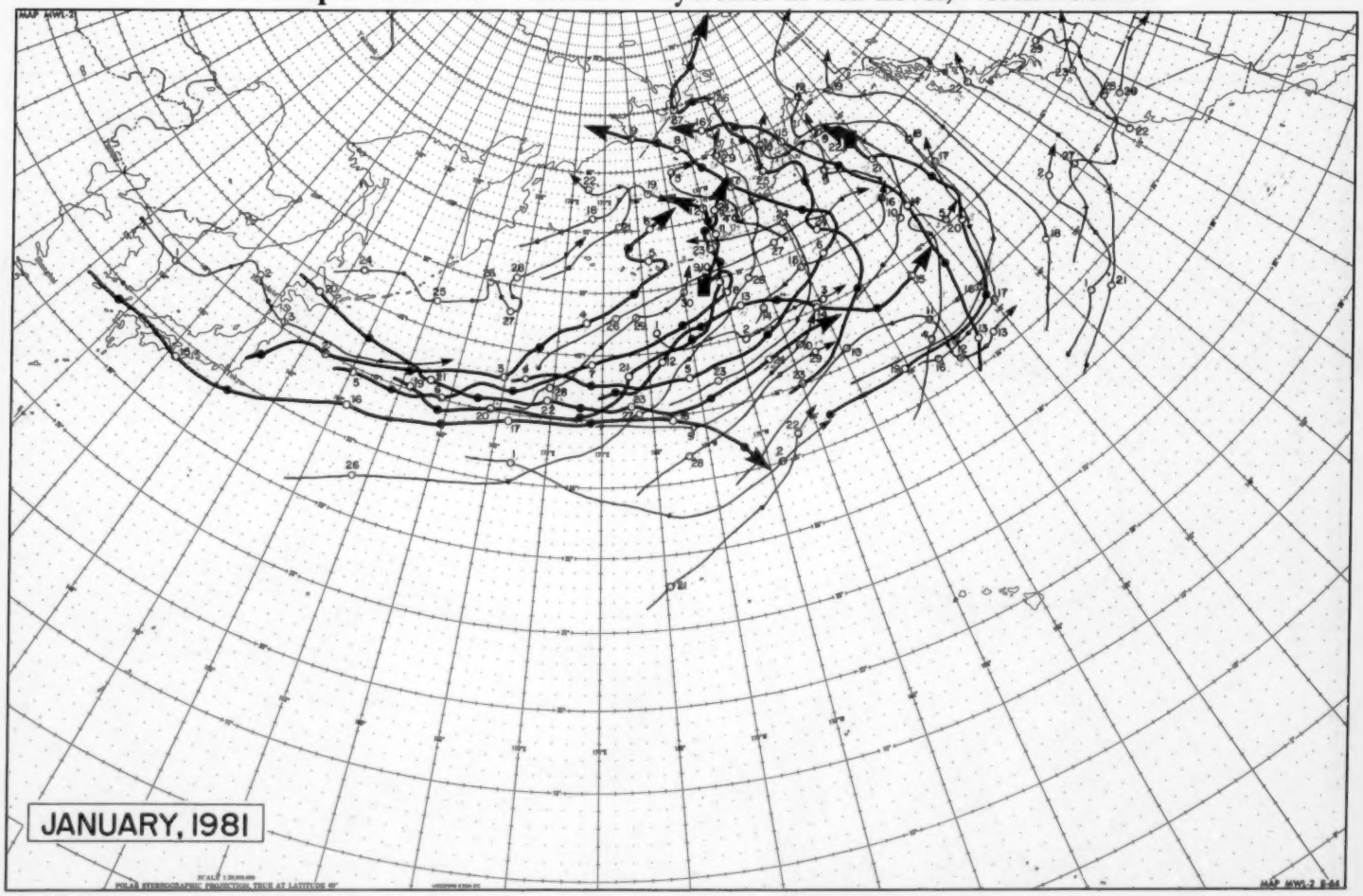


Figure 44.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

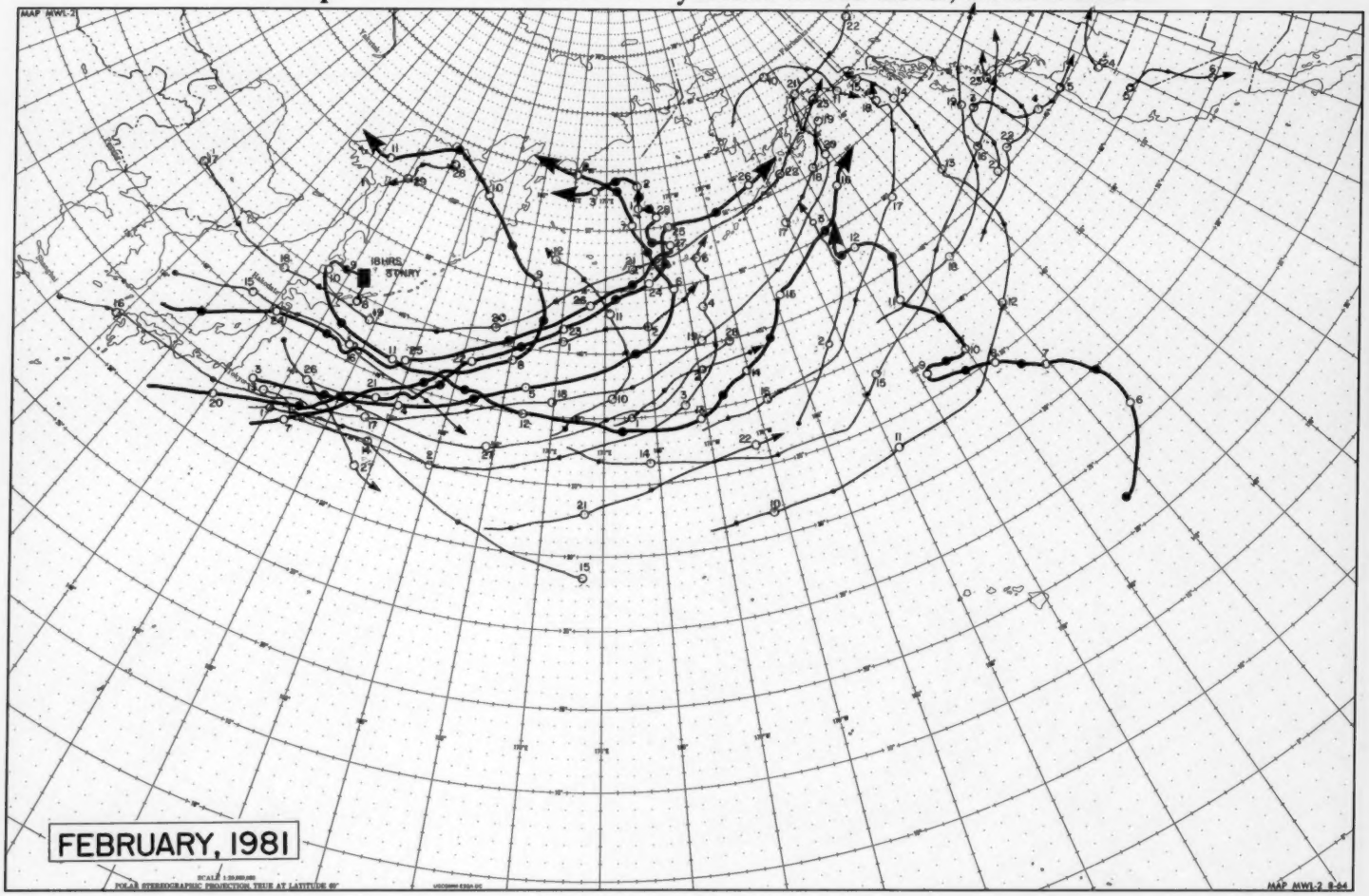


Figure 45.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

January and February 1981

JANUARY DATA SUMMARY 41001

AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
PRESSURE (MBAR)	1000.4	(21 21)	1021.9	1039.9	(13 15)	179	26

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.1	4.8	4.8	.8		12.2	19.3
NE		1.1	5.3	.5			6.9	15.8
E		3.2	5.9	1.6			10.6	15.9
SE		1.6	9.0	1.6			12.2	15.7
S		1.1	2.1	3.2	1.1		7.4	22.8
SW	.5	.5	2.7	2.1			5.9	19.5
W		1.1	9.0	3.7	1.6		15.4	19.7
NW		2.1	9.6	14.9	2.7		29.3	22.8
CALM								
TOTAL	.5	12.8	48.4	32.4	5.9		100.0	19.6

NO. OF WAVE OBS: 191

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	2.1	25.7	33.5	20.9	14.7	3.1			2.6M	6.5M	(18 09)

FEBRUARY DATA SUMMARY 41001

AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
PRESSURE (MBAR)	1000.4	(21 21)	1021.9	1039.9	(13 15)	170	26

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

NO. OF WAVE OBS: 191

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		18.2	28.2	33.1	10.0	4.4			2.9M	7.0M	(27 03)

JANUARY DATA SUMMARY 41002

AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.4	(12 21)	14.3	19.6	(28 15)	244	31
SEA TEMP (DEG C)	19.8	(31 12)	20.9	22.2	(01 00)	244	31
AIR-SEA TEMP (DEG C)	-18.1	(12 21)	-06.6	-00.6	(28 15)	244	31
PRESSURE (MBAR)	1005.3	(07 21)	1015.7	1026.1	(31 15)	242	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.6	9.0	2.9			13.5	16.6
NE	.4	1.6	2.5				4.9	11.1
E	.4	2.0	1.2				4.8	8.2
SE		.4	.4				.8	9.5
S	.4	.6	3.7	2.5			7.4	18.6
SW		2.9	7.4	3.3			13.5	16.0
W	.4	4.5	12.7	9.4			27.0	17.4
NW	.4	2.5	13.9	10.7			27.5	18.8
CALM	.8						.8	.0
TOTAL	2.9	17.2	51.2	28.7			100.0	16.6

NO. OF WAVE OBS: 244

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	.8	36.5	35.2	20.5	7.0				2.2M	5.5M	(05 03)

FEBRUARY DATA SUMMARY 41002

AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.1	(04 03)	15.9	30.4	(11 21)	223	28
SEA TEMP (DEG C)	19.6	(25 06)	19.4	20.0	(03 03)	223	28
AIR-SEA TEMP (DEG C)	-12.7	(04 03)	-03.5	01.0	(20 21)	223	28
PRESSURE (MBAR)	1003.7	(21 21)	1021.8	1038.7	(13 15)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN 1-SPEED (KNOTS)
N		1.3	4.5	1.8			8.1	15.5
NE		.9	9.1	9.0			19.5	23.0
E		3.1	11.7	.9			15.7	14.4
SE		.4	4.4	4.5			9.9	19.4
S		.9	4.0	5.8	.9		11.7	22.3
SW			2.2	1.8			4.0	20.0
W		.9	8.5	5.4			14.8	20.0
NW		1.1	14.3	6.7			22.4	19.6
CALM								
TOTAL		4.4	53.4	36.3	.9		100.0	19.3

NO. OF WAVE OBS: 223

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		17.7	33.2	35.4	11.7				2.7M	5.4M	(02 10)

JANUARY DATA SUMMARY 41004

AVERAGE LATITUDE 32.6N AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-02.1	(12 18)	10.4	18.4	(21 09)	244	31
SEA TEMP (DEG C)	16.7	(19 12)	18.4	20.9	(21 06)	244	31
AIR-SEA TEMP (DEG C)	-20.7	(12 18)	-08.0	-00.5	(28 06)	244	31
PRESSURE (MBAR)	1007.7	(21 09)	1016.6	1031.7	(05 15)	241	31

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	19.3	59.0	20.5	1.2					1.3M	3.5M	(05 03)

FEBRUARY DATA SUMMARY 41004

AVERAGE LATITUDE 32.5N AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.4	(12 18)	11.7	18.0	(28 06)	244	31
SEA TEMP (DEG C)	18.6	(09 06)	19.3	20.6	(08 18)	244	31
AIR-SEA TEMP (DEG C)	-19.5	(12 18)	-07.7	-00.3	(21 06)	244	31
PRESSURE (MBAR)	1010.0	(28 09)	1019.3	1031.0	(05 15)	239	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	6.6	13.1	1.6			22.1	13.9
NE		2.5	7.8	.8			11.1	14.1
E		.8					.8	8.0
SE		1.2					1.2	7.8
S		.4	.8				1.2	12.0
SW		3.7	5.7	.4			9.4	13.0
W	2.0	9.0	19.7	1.6			32.4	12.8
NW		7.0	13.9	.4			21.3	12.9
CALM								
TOTAL	2.9	31.1	61.1	4.9			100.0	13.0

NO. OF WAVE OBS: 244

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	14.3	51.2	31.1	3.3					1.5M	3.5M	(05 06)

FEBRUARY DATA SUMMARY 41005

AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.4	(13 18)	15.8	22.0	(11 06)	223	28
SEA TEMP (DEG C)	17.9	(12 15)	19.8	22.3	(27 18)	223	28
AIR-SEA TEMP (DEG C)	-16.5	(03 15)	-04.7	02.9	(11 12)	223	28
PRESSURE (MBAR)	1004.7	(20 21)	1021.4	1038.6	(13 15)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	4.5	3.6	2.2			10.8	12.9
NE		4.9	4.5	1.6			11.0	16.1
E		1.3	7.6				9.0	15.5
SE	.9	.4	7.2	1.3			9.9	15.0
S	.4	1.3	4.9	1.6			10.3	17.4
SW	.4	2.2	4.5				7.2	10.6
W	.9	3.1	14.6	1.3			20.2	14.9
NW	.4	1.8	12.6	1.2			16.1	14.8
CALM								
TOTAL	3.1	19.7	61.4	8.7			100.0	14.8

NO. OF WAVE OBS: 223

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	5.4	44.4	22.9	15.2	12.1				2.1M	4.5M	(14 21)

JANUARY — DATA SUMMARY — 42001

AVERAGE LATITUDE 25.9N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.0	(13 03)	18.0	23.0	(30 21)	244	31
SEA TEMP (DEG C)	20.1	(19 12)	21.6	23.3	(25 21)	244	31
AIR-SEA TEMP (DEG C)	-09.5	(12 18)	-03.6	00.3	(31 18)	244	31
PRESSURE (MBAR)	1010.9	(28 00)	1021.0	1030.7	(18 03)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	
	4-	11-	22-	34-				NO. OF OBS: 243
DIR	<4	10	21	33	>47	%	(KNOTS)	
N	.8	6.2	17.3	2.1		26.3	13.7	MAX WIND
NE	2.5	7.4	21.8	.8		32.5	13.2	SPEED: 29 KNOTS
E	1.2	3.3	5.3			9.9	9.6	DIRECTION: 230 DEG
SE	.4	3.7	5.8			9.9	10.7	DAY: 26
S	.4	3.3	5.8	.4		9.9	11.6	HOUR: 12
SW		.4	2.1	.4		2.9	15.9	
W		.4	1.2	.4		2.1	15.8	
NW		2.5	2.9	.8		6.2	14.3	
CALM								
TOTAL	5.3	27.2	62.1	5.3		100.0	12.8	

FEBRUARY — DATA SUMMARY — 42001

AVERAGE LATITUDE 25.9N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.2	(03 18)	19.1	22.7	(10 18)	223	28
SEA TEMP (DEG C)	19.8	(05 12)	21.0	23.0	(21 21)	223	28
AIR-SEA TEMP (DEG C)	-08.5	(03 12)	-01.9	02.2	(10 09)	223	28
PRESSURE (MBAR)	1006.6	(10 21)	1020.8	1032.7	(03 15)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	
	4-	11-	22-	34-				NO. OF OBS: 204
DIR	<4	10	21	33	>47	%	(KNOTS)	
N	1.0	9.7	16.2	0.0		27.7	15.1	MAX WIND
NE	.5	6.3	14.1			20.9	12.8	SPEED: 31 KNOTS
E	1.5	5.3	6.6			13.6	10.3	DIRECTION: 330 DEG
SE		2.9	6.8	1.9		11.7	19.7	DAY: 11
S		2.9	2.4			5.3	10.6	HOUR: 15
SW		2.4	.5			2.9	7.7	
W		3.9	.5			4.4	7.7	
NW	.5	6.3	4.4	1.5		12.6	12.6	
CALM	1.0					1.0	.0	
TOTAL	4.4	39.8	46.6	9.2		100.0	12.4	

JANUARY — DATA SUMMARY — 42002

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.1	(13 00)	18.2	22.5	(06 21)	244	31
SEA TEMP (DEG C)	20.5	(24 12)	21.7	22.8	(06 12)	244	31
AIR-SEA TEMP (DEG C)	-09.4	(13 00)	-03.5	00.5	(07 00)	244	31
PRESSURE (MBAR)	1011.8	(20 00)	1022.1	1033.2	(18 06)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	
	4-	11-	22-	34-				NO. OF OBS: 244
DIR	<4	10	21	33	>47	%	(KNOTS)	
N	.4	9.8	14.3	.4		25.0	12.1	MAX WIND
NE	.8	5.3	14.8	1.2		21.3	14.7	SPEED: 28 KNOTS
E	.4	7.4	9.0	.4		17.2	11.3	DIRECTION: 130 DEG
SE	.8	5.3	7.0	.4		13.5	10.9	DAY: 19
S		2.0	4.1	.4		6.6	11.3	HOUR: 21
SW	.4	2.0		.4		2.9	7.3	
W		2.5	2.5	.8		5.7	14.3	
NW		2.5	4.5			7.0	12.2	
CALM								
TOTAL	2.0	37.7	56.1	4.1		100.0	12.3	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	30.7	48.8	16.0	4.5					1.2M	3.5M (17 21)

FEBRUARY — DATA SUMMARY — 42002

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.8	(12 00)	18.9	22.2	(10 21)	223	28
SEA TEMP (DEG C)	20.1	(14 06)	21.1	22.7	(19 21)	223	28
AIR-SEA TEMP (DEG C)	-10.1	(12 00)	-02.2	01.1	(10 18)	223	28
PRESSURE (MBAR)	1005.1	(10 21)	1021.7	1033.0	(13 18)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	
	4-	11-	22-	34-				NO. OF OBS: 222
DIR	<4	10	21	33	>47	%	(KNOTS)	
N	.5	2.7	10.8	5.0		18.9	17.5	MAX WIND
NE		5.0	11.3	1.4		17.6	14.1	SPEED: 30 KNOTS
E	3.2	5.1	6.8			15.0	9.3	DIRECTION: 350 DEG
SE	.9	3.2	22.1			26.1	13.4	DAY: 11
S	.9	3.2	5.0			9.0	11.2	HOUR: 15
SW	.5	2.2				2.6	5.9	
W		2.3				2.3	9.6	
NW	.9	.5	.9	.9		3.2	12.1	
CALM	1.4					1.4	.0	
TOTAL	8.1	27.9	56.8	7.2		100.0	12.7	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 223

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	22.9	44.4	25.1	5.4	2.2				1.5M	5.5M (11 21)

JANUARY — DATA SUMMARY — 42003

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.8	(12 21)	18.1	24.1	(20 18)	244	31
SEA TEMP (DEG C)	21.1	(12 15)	24.2	26.0	(03 18)	244	31
AIR-SEA TEMP (DEG C)	-12.6	(13 03)	-06.1	01.6	(07 15)	244	31
PRESSURE (MBAR)	1018.2	(20 21)	1020.0	1029.9	(18 15)	241	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	
	4-	11-	22-	34-				NO. OF OBS: 244
DIR	<4	10	21	33	>47	%	(KNOTS)	
N	.4	14.8	29.1	1.2		45.6	12.7	MAX WIND
NE	.8	7.4	8.6			16.8	9.3	SPEED: 25 KNOTS
E	1.6	5.7	4.5			11.9	9.1	DIRECTION: 230 DEG
SE	.4	5.3	2.5			8.2	8.5	DAY: 26
S	.8	1.2	3.3	.8		6.1	11.9	HOUR: 21
SW	.4	.8	1.6	.8		3.9	13.4	
W	.8	.4	3.3			4.5	13.9	
NW	.4	3.7	2.5			6.6	8.9	
CALM								
TOTAL	5.7	38.9	53.3	2.0		100.0	11.2	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	35.6	54.1	10.7	1.6					1.1M	3.5M (20 21)

FEBRUARY — DATA SUMMARY — 42003

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.6	(04 03)	20.4	28.1	(02 09)	223	28
SEA TEMP (DEG C)	20.7	(03 15)	23.7	29.6	(21 21)	223	28
AIR-SEA TEMP (DEG C)	-09.6	(12 12)	-03.3	01.3	(07 15)	223	28
PRESSURE (MBAR)	1008.7	(10 21)	1020.0	1031.1	(12 15)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	
	4-	11-	22-	34-				NO. OF OBS: 223
DIR	<4	10	21	33	>47	%	(KNOTS)	
N	.9	7.2	9.8	3.6		21.5	13.2	MAX WIND
NE	.9	4.5	11.7	2.7		19.7	15.7	SPEED: 27 KNOTS
E	.4	5.8	14.8			21.1	14.0	DIRECTION: 010 DEG
SE		3.6	10.3	.9		14.8	14.8	DAY: 12
S		1.4	6.7	1.3		9.9	15.6	HOUR: 09
SW		.9	1.3			2.2	13.8	
W		2.7		.4		3.1	9.0	
NW	.9	2.2	9.0			12.1	12.4	
CALM								
TOTAL	3.1	28.3	59.6	9.0		100.0	14.2	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 223

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	17.2	41.7	32.3	9.4	1.3				1.7M	4.2M (12 09)

JANUARY — DATA SUMMARY — 42007

AVERAGE LATITUDE 30.1N — AVERAGE LONGITUDE 088.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	00.4	(17 15)	10.0	16.3	(31 00)	120	16
SEA TEMP (DEG C)	04.8	(16 15)	11.5	13.0	(30 00)	120	16
AIR-SEA TEMP (DEG C)	-10.5	(18 12)	-01.5	04.5	(26 15)	120	16
PRESSURE (MBAR)	1005.9	(20 18)	1020.6	1035.0	(17 15)	119	16

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	
	4-	11-	22-	34-				NO. OF OBS: 120
DIR	<4	10	21	33	>47	%	(KNOTS)	
N	.8	7.5	14.2			22.5	12.7	MAX WIND
NE	.8	5.0	5.8	.8		12.5	12.2	SPEED: 28 KNOTS
E		4.2	4.2	1.7		10.0	14.6	DIRECTION: 210 DEG
SE	1.7	11.7	.8			14.2	8.6	DAY: 20
S	1.7	6.7	1.7			10.0	9.6	HOUR: 18
SW	1.7	3.3		.8		5.8	7.7	
W		7.5	1.7	.8		10.0	10.4	
NW		4.7	0.7			11.3	9.9	
CALM	1.7					1.7	.0	
TOTAL	8.3	52.5	35.0	4.2		100.0	10.3	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 107

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	84.1	13.1	2.8						.4M	2.0M (31 21)

FEBRUARY — DATA SUMMARY — 42007

AVERAGE LATITUDE 30.1N — AVERAGE LONGITUDE 088.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.6	(02 03)	15.1	18.2	(28 21)	75	11
SEA TEMP (DEG C)	12.1	(01 03)	14.1	17.3	(27 21)	75	11
AIR-SEA TEMP (DEG C)	-07.2	(02 03)	01.0	05.0	(01 18)	75	11
PRESSURE (MBAR)	1007.6	(01 21)	1017.5	1023.2	(27 15)	75	11

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	
	4-	11-	22-	34-				NO. OF OBS: 75
DIR	<4	10	21	33	>47	%	(KNOTS)	
N		2.7	1.3			4.0	8.0	MAX WIND
NE	2.7	4.				6.7	4.0	SPEED: 23 KNOTS
E	1.3	2.7	2.7	1.3		8.0	12.0	DIRECTION: 330 DEG
SE	1.3	16.0	6.7			24.0	9.2	DAY: 02
S	2.7	9.3	1.3			12.0	6.8	HOUR: 08
SW	2.7	4.	4.7			10.7	9.8	
W	4.0	9.3	6.7			20.0	9.1	
NW	2.7	1.3	2.7	1.3		8.0	9.3	
CALM	1.3					1.3	.0	
TOTAL	18.7	50.7	28.0	2.7		100.0	8.7	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 68

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	81.2	14.6	4.2						.4M	2.0M (01 09)

JANUARY DATA SUMMARY 42208
AVERAGE LATITUDE 28.7N AVERAGE LONGITUDE 095.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.9	(25 12)	12.8	17.5	(27 15)	216	31
SEA TEMP (DEG C)	10.0	(21 12)	12.7	14.3	(05 00)	217	31
AIR-SEA TEMP (DEG C)	-07.6	(17 18)	-00.6	04.0	(27 15)	217	31
PRESSURE (MBAR)	1011.0	(27 21)	1022.2	1037.5	(17 18)	200	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
N	.9	9.1	11.1	.5	17.6	12.1
NE	.9	7.4	10.7	2.8	27.8	14.0
E	2.3	8.3	5.6		16.2	9.4
SE	2.3	4.0	.5		6.8	6.4
S	1.4	6.9	3.2		11.6	8.3
SW		1.9	1.9		3.7	10.6
W	.5	2.8	1.4		4.6	8.3
NW	.9	3.7	3.7		8.3	9.1
CALM	1.4				1.4	.0
TOTAL	10.6	42.1	44.0	3.2	100.0	10.6

MAX WIND SPEED: 31 KNOTS DIRECTION: 020 DEG DAY: 19 HOUR: 18

NO. OF OBS: 216

FEBRUARY DATA SUMMARY 42009
AVERAGE LATITUDE 28.7N AVERAGE LONGITUDE 095.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-09.5	(11 12)	12.3	18.7	(21 00)	221	28
SEA TEMP (DEG C)	10.1	(18 12)	12.1	14.7	(23 21)	221	28
AIR-SEA TEMP (DEG C)	-18.1	(11 12)	00.2	05.1	(10 09)	221	28
PRESSURE (MBAR)	0999.3	(10 09)	1022.0	1048.3	(12 03)	221	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
N		7.3	8.3	3.7	19.3	15.0
NE		6.7	10.4	1.4	18.5	14.4
E	.9	13.6	8.7	1.4	25.2	13.1
SE		8.3	1.4	.9	10.6	10.5
S	.9	4.4	2.8		7.8	9.3
SW		4.4	4.8		9.6	10.8
W	.5	1.4	.5		2.3	8.8
NW		3.2	1.8	1.4	.5	6.9	15.0
CALM							
TOTAL	1.8	49.1	39.8	9.6	.9	100.0	12.4

MAX WIND SPEED: 36 KNOTS DIRECTION: 330 DEG DAY: 11 HOUR: 06

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: .9% SEVERE: NONE OBS: 216

JANUARY DATA SUMMARY 42039
AVERAGE LATITUDE 29.3N AVERAGE LONGITUDE 087.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
SEA TEMP (DEG C)	18.1	(21 09)	19.2	20.8	(01 21)	245	31
PRESSURE (MBAR)	1007.9	(20 18)	1021.7	1033.5	(18 15)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
N	.4	10.8	28.8	1.6	41.6	11.9
NE	.4	4.5	5.3		9.2	10.8
E	1.2	2.9	1.6		5.7	8.4
SE	.8	3.3	1.2		5.3	10.2
S	.8	6.5	2.9		10.2	9.7
SW	.8	1.2	1.6		3.7	9.3
W		2.0	2.9	.4	5.3	12.8
NW	1.6	5.4	4.9		15.9	8.9
CALM	1.2				1.2	.0
TOTAL	7.3	46.6	42.0	2.0	100.0	10.3

MAX WIND SPEED: 26 KNOTS DIRECTION: 260 DEG DAY: 20 HOUR: 21

NO. OF OBS: 245

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	43.9	42.3	11.3	2.1	.4				1.0M	4.0M	(20 21)

FEBRUARY DATA SUMMARY 42009
AVERAGE LATITUDE 29.3N AVERAGE LONGITUDE 087.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
SEA TEMP (DEG C)	17.3	(12 18)	18.6	21.6	(26 21)	223	28
PRESSURE (MBAR)	1005.9	(10 12)	1021.3	1038.1	(12 15)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
N	.9	5.4	3.6	2.2	12.0	12.2
NE	.9	6.3	6.3	.4	13.9	10.5
E	2.2	3.6	13.9	.4	20.2	13.1
SE		.9	6.3	.9	8.1	17.6
S		3.1	3.6	.9	7.6	13.0
SW	.4	2.2	.4		3.1	7.4
W	.4	6.7	9.0		16.1	11.5
NW		9.4	5.8	1.8	17.0	11.4
CALM	1.3				1.3	.0
TOTAL	5.3	36.1	48.9	4.7	100.0	12.1

MAX WIND SPEED: 25 KNOTS DIRECTION: 350 DEG DAY: 02 HOUR: 12

NO. OF OBS: 223

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 223

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	39.5	27.8	20.5	9.4	1.8				1.5M	4.5M	(10 17)

JANUARY DATA SUMMARY 44003
AVERAGE LATITUDE 40.7N AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-11.3	(05 06)	00.8	07.6	(27 15)	244	31
SEA TEMP (DEG C)	03.4	(31 21)	04.7	06.5	(02 03)	244	31
AIR-SEA TEMP (DEG C)	-17.3	(05 06)	-04.7	03.2	(27 03)	244	31
PRESSURE (MBAR)	0997.7	(06 00)	1011.9	1026.1	(09 15)	242	31

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	2.5	34.6	31.9	13.9	14.7	.4			2.3M	6.0M	(03 06)

FEBRUARY DATA SUMMARY 44003
AVERAGE LATITUDE 40.8N AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-08.7	(04 12)	02.7	09.5	(12 00)	218	28
SEA TEMP (DEG C)	02.0	(07 18)	03.6	04.9	(24 21)	219	28
AIR-SEA TEMP (DEG C)	-09.3	(04 12)	-00.9	04.5	(12 03)	218	28
PRESSURE (MBAR)	0989.6	(26 09)	1020.5	1048.9	(13 15)	219	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
N		.5	8.3	2.3	11.0	17.0
NE		2.3	3.7		6.0	11.3
E	.9	5.5	11.5		17.9	12.1
SE		3.2	8.2		11.5	12.7
S		6.0	6.0	2.3	14.2	13.6
SW		5.5	4.6	.9	10.6	10.6
W	.9	6.0	10.1	3.2	20.2	14.9
NW	.5	1.8	5.0	.9	8.2	14.1
CALM	.5				.5	.0
TOTAL	2.8	30.7	57.3	9.2	100.0	13.9

MAX WIND SPEED: 27 KNOTS DIRECTION: 260 DEG DAY: 28 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 218

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	4.0	28.7	28.2	18.8	20.2	2.8			2.8M	7.5M	(01 09)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 5.0% SEVERE: NONE OBS: 218

JANUARY DATA SUMMARY 44004
AVERAGE LATITUDE 39.0N AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-05.2	(05 18)	04.4	11.8	(27 06)	244	31
SEA TEMP (DEG C)	09.1	(16 03)	13.7	16.8	(02 09)	244	31
AIR-SEA TEMP (DEG C)	-21.5	(05 03)	-09.3	01.4	(27 06)	244	31
PRESSURE (MBAR)	0999.2	(07 18)	1013.1	1029.0	(31 15)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
N		2.0	8.2	7.8	.8	18.9	20.4
NE		2.5	.4	1.6		4.5	13.7
E	.4	2.9	2.5			5.7	10.2
SE		.8	3.3			4.1	12.5
S		1.2	2.0	.4		3.7	13.0
SW		.8	5.3	1.6	.4	8.2	17.6
W	.4	1.6	6.1	7.8	1.2	17.2	20.8
NW		2.9	13.5	20.9	.4	37.7	21.8
CALM							
TOTAL	.8	14.8	41.4	40.2	2.9	100.0	19.3

MAX WIND SPEED: 38 KNOTS DIRECTION: 010 DEG DAY: 10 HOUR: 15

NO. OF OBS: 244

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	1.6	35.2	30.7	18.0	13.1	1.2			2.6M	6.8M	(07 18)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 7.4% SEVERE: NONE OBS: 244

FEBRUARY DATA SUMMARY 44004
AVERAGE LATITUDE 39.0N AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-07.2	(05 18)	00.4	10.4	(24 00)	221	28
SEA TEMP (DEG C)	10.0	(14 06)	12.7	16.1	(22 03)	221	28
AIR-SEA TEMP (DEG C)	-17.2	(05 18)	-04.3	03.7	(12 03)	221	28
PRESSURE (MBAR)	0981.1	(26 06)	1020.8	1047.3	(13 15)	221	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
N		2.7	6.3	.5	9.0	15.1
NE		.9	4.5	4.1	9.5	24.1
E		1.4	3.2	3.6	8.6	18.5
SE		2.7	5.9	5.0	.5	14.5	19.6
S		4.5	7.2	7.6		15.4	16.0
SW		1.4	1.8	.9		3.6	12.0
W	.9	2.3	9.0	10.8	1.4	24.3	22.3
NW	.5	1.4	8.6	7.2	2.7	20.4	21.6
CALM	.5					.5	.0
TOTAL	1.4	17.6	48.1	39.4	4.5	100.0	19.2

MAX WIND SPEED: 36 KNOTS DIRECTION: 330 DEG DAY: 27 HOUR: 06

NO. OF OBS: 221

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 221

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	4.1	23.1	29.9	18.3	27.1	2.7			2.8M	7.2M	(02 03)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 3.2% SEVERE: NONE OBS: 221

JANUARY D A T A S U M M A R Y 46006
AVERAGE LATITUDE 36.3N AVERAGE LONGITUDE 075.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-07.5	(12 18)	02.4	09.0	(07 06)	239	31
SEA TEMP (DEG C)	04.7	(15 15)	06.4	08.3	(03 21)	238	31
AIR-SEA TEMP (DEG C)	-14.0	(12 18)	-03.9	03.0	(28 00)	238	31
PRESSURE (MBAR)	1004.4	(07 18)	1017.3	1031.0	(31 18)	235	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	1.7	17.2	9.4			27.6	18.1
NE	.4	.4	2.9				3.7	11.4
E		.4					.4	9.0
SE	.4	.8					1.3	9.7
S	.4	6.3	6.7				13.4	11.2
SW		9.4	6.3				11.7	11.1
W	.8	9.4	8.7	.8			19.7	11.2
NW		5.4	9.6	9.6			24.7	18.2
CALM								
TOTAL	2.5	29.3	49.4	18.8			100.0	14.8

NO. OF OBS: 239
MAX WIND
SPEED: 32 KNOTS
DIRECTION: 340 DEG
DAY: 17
HOUR: 06

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE:15.1% SEVERE: NONE #OBS: 234

FEBRUARY D A T A S U M M A R Y 46006
AVERAGE LATITUDE 36.3N AVERAGE LONGITUDE 075.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-03.5	(05 18)	05.7	13.0	(19 00)	216	28
SEA TEMP (DEG C)	02.8	(07 03)	05.5	07.4	(18 21)	215	28
AIR-SEA TEMP (DEG C)	-09.3	(12 18)	00.1	07.0	(23 06)	215	28
PRESSURE (MBAR)	0999.2	(20 21)	1021.2	1046.3	(13 15)	216	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	2.3	13.8	6.0			22.5	17.1
NE	.8	2.8	.5				3.7	7.6
E	.9	2.8	1.8				5.5	8.0
SE	.9	4.6	7.3	.5			13.3	11.6
S	.5	4.9	6.4	5.0			16.8	14.1
SW		3.7	7.2				6.9	9.8
W	.9	2.3	6.9	.5			10.6	12.2
NW		1.4	10.1	7.3			18.8	18.7
CALM								
TOTAL	4.1	26.6	50.0	19.3			100.0	14.2

NO. OF OBS: 210
MAX WIND
SPEED: 32 KNOTS
DIRECTION: 180 DEG
DAY: 02
HOUR: 18

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 5.0% SEVERE: NONE #OBS: 210

JANUARY D A T A S U M M A R Y 46001
AVERAGE LATITUDE 50.7N AVERAGE LONGITUDE 148.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.6	(20 12)	04.3	09.9	(30 12)	244	31
SEA TEMP (DEG C)	04.0	(31 21)	04.1	04.2	(24 09)	244	31
AIR-SEA TEMP (DEG C)	-03.4	(20 12)	00.2	01.9	(30 12)	244	31
PRESSURE (MBAR)	0969.6	(18 06)	0992.0	1014.9	(05 06)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	.4	2.9	1.2	.4		5.3	19.2
NE	.4	1.6	7.4	4.1			13.5	17.3
E	.8	7.4	9.4	4.5			22.1	14.6
SE	.4	3.3	11.5	7.4			23.0	17.8
S		7.9	15.2	2.9			20.4	15.8
SW	.4	1.2	7.4	.8			9.8	15.1
W		.4	3.3	.8			4.5	16.6
NW								
CALM	.8						.8	.0
TOTAL	3.3	17.2	57.0	22.1	.4		100.0	16.2

MAX WIND
SPEED: 35 KNOTS
DIRECTION: 350 DEG
DAY: 21
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		13.1	26.6	31.6	8.6				4.1M	7.5M (30 03)

FEBRUARY D A T A S U M M A R Y 46001
AVERAGE LATITUDE 50.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-03.0	(21 15)	02.9	08.6	(08 03)	223	28
SEA TEMP (DEG C)	03.7	(28 03)	03.9	04.1	(10 03)	223	28
AIR-SEA TEMP (DEG C)	-06.7	(21 15)	-01.0	01.6	(01 09)	223	28
PRESSURE (MBAR)	0976.5	(20 15)	1005.1	1029.6	(28 21)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9	4.1	.5	.5			5.9	9.3
NE		7.2	3.6				10.8	9.8
E	.5	1.8	3.2	1.4			6.8	18.0
SE		6.8	14.4	2.7			23.9	15.1
S	.9	5.4	11.7	3.2			21.2	15.2
SW	1.4	6.8	4.5	4.5			17.4	12.8
W	3.2	2.3	5.0	1.4			10.8	11.9
NW	.5	1.4	.9				2.7	8.2
CALM	.5						.5	.0
TOTAL	7.2	35.6	43.7	13.5			100.0	13.2

NO. OF OBS: 222
MAX WIND
SPEED: 32 KNOTS
DIRECTION: 210 DEG
DAY: 28
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 221

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		.4	37.6	25.8	23.5	9.5			3.1M	7.5M (22 00)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 1.4% SEVERE: NONE #OBS: 222

JANUARY D A T A S U M M A R Y 46002
AVERAGE LATITUDE 42.5N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.7	(28 12)	11.9	15.1	(18 15)	244	31
SEA TEMP (DEG C)	11.6	(28 15)	12.5	12.8	(07 00)	244	31
AIR-SEA TEMP (DEG C)	-04.9	(26 12)	-00.5	02.5	(18 15)	244	31
PRESSURE (MBAR)	0983.6	(20 15)	1010.9	1029.0	(31 06)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	2.0	2.6	1.2	.4		6.6	14.9
NE	1.2	.4		.4	.8		2.9	15.6
E	.4	1.2	.4	.4			2.5	10.2
SE		4.5	6.6	4.2	.8		22.1	18.6
S	.4	3.3	24.2	6.6	.8		35.2	17.4
SW		4.1	4.1	2.5			10.7	14.3
W	.8	3.7	9.3	.4			10.2	11.7
NW			7.0	7.0	.8		9.8	14.8
CALM								
TOTAL	3.7	21.3	51.6	20.5	2.9		100.0	16.1

MAX WIND
SPEED: 38 KNOTS
DIRECTION: 240 DEG
DAY: 20
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		2.5	17.2	23.0	41.0	12.7	3.7		4.2M	9.0M (20 18)

FEBRUARY D A T A S U M M A R Y 46002
AVERAGE LATITUDE 42.5N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.9	(24 09)	10.9	13.7	(16 06)	223	28
SEA TEMP (DEG C)	11.3	(08 15)	11.7	12.2	(21 21)	223	28
AIR-SEA TEMP (DEG C)	-04.7	(24 09)	-00.8	02.1	(16 06)	223	28
PRESSURE (MBAR)	1001.6	(19 03)	1017.2	1036.4	(20 18)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9	3.2	5.4	.5			10.0	10.8
NE	.5	3.2	5.4				9.0	11.2
E	.5	2.7	9.4				7.6	11.9
SE		4.5	4.1	.9			9.5	13.9
S	.9	5.9	17.6	3.6			28.0	14.9
SW	.5	4.5	10.9	1.8			17.6	14.6
W	.9	2.3	2.3	3.2			8.6	15.7
NW		.9	10.9	2.7			14.6	16.1
CALM								
TOTAL	4.1	27.1	66.1	12.7			100.0	13.8

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 150 DEG
DAY: 13
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 223

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		16.1	28.7	26.9	28.3	2.7			3.1M	7.5M (19 21)

JANUARY D A T A S U M M A R Y 46003
AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-01.2	(18 21)	03.5	08.7	(03 09)	244	31
SEA TEMP (DEG C)	04.2	(22 12)	04.8	05.3	(04 00)	244	31
AIR-SEA TEMP (DEG C)	-05.5	(18 21)	-01.3	00.8	(29 00)	244	31
PRESSURE (MBAR)	0968.9	(07 00)	0990.6	1016.7	(05 09)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.8	2.5	5.3			8.6	21.0
NE		.8	1.6	1.6			4.1	20.4
E		1.2	5.8	4.9	.8		12.8	20.4
SE		.8	5.8	7.8			14.4	20.4
S		2.9	4.1	5.8	1.6		14.4	20.4
SW	.8	4.5	4.1	5.3			14.8	18.3
W		2.9	10.7	8.6	2.1		24.3	20.4
NW			.8	2.1	4.1		7.0	22.1
CALM								
TOTAL	.8	14.8	38.8	43.6	9.8		100.0	20.0

NO. OF OBS: 243
MAX WIND
SPEED: 41 KNOTS
DIRECTION: 280 DEG
DAY: 25
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 236

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY			20.3	36.4	39.8	3.4			3.7M	7.0M (04 18)

FEBRUARY D A T A S U M M A R Y 46003
AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.4	(01 12)	04.9	08.5	(04 21)	54	7
SEA TEMP (DEG C)	04.2	(02 21)	04.4	04.6	(07 18)	54	7
AIR-SEA TEMP (DEG C)	-01.9	(01 12)	00.5	02.6	(04 21)	54	7
PRESSURE (MBAR)	0990.0	(01 12)	1004.9	1012.4	(02 21)	53	7

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.3					1.3	6.4
NE			.9	4.5	4.0		9.4	19.3
E			1.5	8.1	2.7		12.4	18.1
SE			2.2	5.0	4.5	.4	20.6	20.2
S		.4	2.2	9.9	5.8	1.8	20.2	18.9
SW			1.3	10.8	5.8	.9	18.8	19.7
W		.9	.9	1.3	7.6		10.3	23.6
NW		.4	1.8	2.2	2.2		6.7	17.4
CALM								
TOTAL		1.7	12.6	48.7	37.2	3.1	100.0	19.5

NO. OF OBS: 223
MAX WIND
SPEED: 41 KNOTS
DIRECTION: 240 DEG
DAY: 28
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 212

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY			2.4	14.6	36.8	37.7	7.5		3.6M	7.5M (21 03)

JANUARY DATA SUMMARY 46004
AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 134.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.5	(27 03)	07.9	10.2	(13 15)	244	31
SEA TEMP (DEG C)	06.9	(30 18)	07.2	07.5	(10 15)	244	31
AIR-SEA TEMP (DEG C)	-02.5	(27 00)	00.7	02.8	(13 15)	244	31
PRESSURE (MBAR)	0961.9	(19 00)	1002.8	1023.1	(30 00)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	%	MEAN SPEED (KNOTS)
N	.8	.8	1.2	.8			3.7	12.8
NE			.8				.8	12.0
E		.4	1.6	4.5	2.5		9.0	27.3
SE		.8	4.9	10.4	6.1		30.3	26.9
S	.8	3.3	12.3	13.1	3.3		32.8	21.4
SW		.4	3.3	1.6	.8		6.1	20.1
W	.4	1.6	2.0	5.7	.4		10.2	21.7
NW		.4	1.2	2.9	2.0		7.0	25.5
CALM								
TOTAL	2.0	6.2	27.5	47.1	15.2		100.0	23.5

NO. OF OBS: 244
MAX WIND SPEED: 43 KNOTS DIRECTION: 120 DEG DAY: 28 HOUR: 21

FEBRUARY DATA SUMMARY 46004
AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 134.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.7	(22 03)	06.3	08.9	(03 09)	222	28
SEA TEMP (DEG C)	06.2	(28 12)	06.7	07.1	(22 00)	222	28
AIR-SEA TEMP (DEG C)	-04.1	(22 00)	-00.4	02.0	(01 09)	222	28
PRESSURE (MBAR)	0973.6	(13 21)	1013.0	1035.6	(06 18)	222	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	%	MEAN SPEED (KNOTS)
N	1.4	7.7	14.0	5.4			28.4	15.0
NE	.5		.9				2.3	8.9
E			.9	3.2	1.4		5.4	17.3
SE		1.4	9.5	.5	1.8		13.1	17.7
S	.5	3.8	9.4	5.8	3.4		19.0	20.0
SW	.5	.9	6.3	6.3	1.8		15.8	22.0
W		2.7		.5	2.3		5.4	21.3
NW	.5	4.3	3.2	2.3	.9		11.0	13.6
CALM								
TOTAL	3.2	25.2	42.3	21.2	9.1		100.0	17.3

NO. OF OBS: 222
MAX WIND: SPEED: 45 KNOTS DIRECTION: 300 DEG DAY: 19 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY			31.3	35.4	33.3				3.3M	6.0M (2 00)

NO. OF WAVE OBS: 96

JANUARY DATA SUMMARY 46005
AVERAGE LATITUDE 48.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.0	(28 15)	10.3	13.4	(10 21)	248	31
SEA TEMP (DEG C)	09.4	(31 00)	10.6	11.0	(05 21)	248	31
AIR-SEA TEMP (DEG C)	-03.5	(23 00)	-00.3	02.7	(16 21)	248	31
PRESSURE (MBAR)	0979.5	(20 21)	1008.3	1026.3	(31 06)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	%	MEAN SPEED (KNOTS)
N		1.4	4.2	1.4			7.0	16.1
NE								
E			2.3		.5		2.8	21.4
SE		.9	10.2	14.6	1.9		27.7	21.8
S		.5	18.8	12.2	2.3		33.8	21.4
SW			1.9	1.4			3.3	21.7
W		.5	4.7	3.3	.5		8.9	19.9
NW		1.9	5.6	.9			8.5	14.6
CALM								
TOTAL		5.2	55.9	33.8	5.2		100.0	20.8

NO. OF OBS: 213

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		.4	10.6	28.2	39.2	8.6	4.5	.4	4.1M	10.0M (09 06)

NO. OF WAVE OBS: 248

FEBRUARY DATA SUMMARY 46005
AVERAGE LATITUDE 48.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.0	(23 12)	09.1	12.1	(13 09)	223	28
SEA TEMP (DEG C)	07.6	(28 21)	09.7	10.1	(06 03)	223	28
AIR-SEA TEMP (DEG C)	-03.7	(23 12)	-00.5	02.6	(13 09)	220	28
PRESSURE (MBAR)	0967.7	(19 06)	1014.8	1038.5	(21 06)	223	28

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		17.1	29.9	20.9	30.0	9.1	1.4	.5	3.0M	10.0M (16 21)

NO. OF WAVE OBS: 221

JANUARY DATA SUMMARY 46010
AVERAGE LATITUDE 46.2N AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.5	(30 15)	09.6	14.2	(21 09)	244	31
SEA TEMP (DEG C)	07.0	(29 18)	10.5	11.3	(26 21)	244	31
AIR-SEA TEMP (DEG C)	-04.4	(26 09)	-00.9	03.2	(21 09)	244	31
PRESSURE (MBAR)	0994.7	(28 09)	1016.1	1031.7	(31 21)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	%	MEAN SPEED (KNOTS)
N	.4	2.9	2.9				6.1	9.9
NE		3.7	7.4				11.1	12.1
E	.4	7.0	42.2	5.7			55.3	16.2
SE	.8	.8	6.6	1.2			9.4	14.8
S	.4	1.6	2.5				4.5	9.2
SW			.4				.4	15.0
W	.8	2.0	2.0				4.9	9.4
NW	.4	2.0	3.7				6.6	11.4
CALM	1.6						1.6	.0
TOTAL	4.3	20.1	67.6	7.0			100.0	14.8

NO. OF OBS: 244

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		15.9	38.6	26.6	15.8	2.9	.4		2.8M	6.0M (09 15)

NO. OF WAVE OBS: 241

FEBRUARY DATA SUMMARY 46010
AVERAGE LATITUDE 46.2N AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.0	(10 15)	08.5	14.4	(23 00)	222	28
SEA TEMP (DEG C)	06.7	(04 15)	09.6	11.1	(22 21)	222	28
AIR-SEA TEMP (DEG C)	-07.6	(10 15)	-01.1	05.1	(23 03)	222	28
PRESSURE (MBAR)	1000.5	(24 15)	1017.9	1035.3	(21 03)	222	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	%	MEAN SPEED (KNOTS)
N		.4	.9				1.4	9.1
NE	.5	4.3	11.7	.5			16.9	12.4
E	.5	4.3	17.1	1.4			23.2	13.2
SE		1.4	7.2	.9			9.9	15.0
S		4.1	14.4	.5			19.4	14.2
SW		.9	4.8	.5			6.1	14.4
W		2.3	3.6				5.9	12.2
NW	.5	4.1	1.8				6.3	9.0
CALM	.9						.9	.0
TOTAL	2.3	20.2	66.0	3.8			100.0	13.0

NO. OF OBS: 222

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		.5	35.3	23.0	21.6	10.2	5.7		2.7M	7.5M (17 09)

NO. OF WAVE OBS: 202

JANUARY DATA SUMMARY 46011
AVERAGE LATITUDE 34.9N AVERAGE LONGITUDE 120.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.4	(30 15)	13.7	17.8	(01 00)	242	31
SEA TEMP (DEG C)	13.9	(31 18)	14.6	15.6	(12 21)	242	31
AIR-SEA TEMP (DEG C)	-05.6	(30 15)	-00.9	02.8	(01 00)	242	31
PRESSURE (MBAR)	1007.5	(26 00)	1017.5	1026.7	(31 18)	240	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	%	MEAN SPEED (KNOTS)
N	1.2	6.6	7.9				15.7	10.2
NE	2.1	5.8	2.5				10.3	7.6
E	5.8	5.0	.4				11.2	3.8
SE	2.9	7.9	2.5				13.2	9.9
S	2.1	9.1	5.4	1.7			18.2	11.8
SW	.8	2.9	1.7				5.4	10.2
W	2.1	5.0	2.9				9.9	8.2
NW		1.7	7.9	.4			10.4	10.3
CALM	2.5						2.5	.0
TOTAL	19.4	47.5	31.0	2.1			100.0	8.6

NO. OF OBS: 242

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		.4	26.4	31.0	23.6	15.7	2.1		2.6M	7.0M (20 18)

NO. OF WAVE OBS: 242

FEBRUARY DATA SUMMARY 46011
AVERAGE LATITUDE 34.9N AVERAGE LONGITUDE 120.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.1	(26 09)	13.1	17.9	(19 00)	223	28
SEA TEMP (DEG C)	12.3	(25 09)	13.6	15.2	(19 06)	223	28
AIR-SEA TEMP (DEG C)	-03.6	(26 09)	-00.6	03.9	(16 21)	223	28
PRESSURE (MBAR)	1002.8	(09 03)	1017.9	1026.1	(21 06)	223	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	%	MEAN SPEED (KNOTS)
N	1.8	6.1	9.9				19.7	11.1
NE	2.7	3.6	.9				7.2	5.9
E	1.8	3.6	.9				5.8	5.2
SE	1.8	6.1	6.9	1.3			16.1	9.8
S		3.1	3.6	.4			7.2	6.2
SW	.9	.9	.9				2.7	6.2
W	.9	6.3	1.3				8.5	7.6
NW	1.8	13.9	17.9	.9			34.1	11.6
CALM	2.7						2.7	.0
TOTAL	14.3	47.5	38.3	1.8			100.0	9.8

NO. OF OBS: 223

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		6.5	34.5	40.9	11.7	3.3			2.5M	9.0M (25 06)

NO. OF WAVE OBS: 223

JANUARY DATA SUMMARY 46012
AVERAGE LATITUDE 37.4N AVERAGE LONGITUDE 122.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.8	(30 00)	12.8	15.4	(15 00)	244	31
SEA TEMP (DEG C)	12.3	(01 12)	13.3	13.9	(24 00)	244	31
AIR-SEA TEMP (DEG C)	-03.6	(30 00)	-00.4	02.3	(12 03)	244	31
PRESSURE (MBAR)	0999.3	(28 03)	1017.6	1029.1	(31 21)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.1	6.6	5.3				14.0	8.7
NE	2.1	7.8	2.8				12.3	7.5
E	2.5	5.3	.4				8.2	5.8
SE	2.1	6.6	12.3	2.1			23.0	12.4
S	.4	4.5	11.1	2.9			18.9	14.4
SW		.8	3.7				4.5	13.0
W	.4	1.6	2.1	.8			4.9	11.9
NW	.4	2.5	9.5	.4			12.8	13.6
CALM	1.2						1.2	.0
TOTAL	11.1	35.8	46.9	6.2			100.0	11.1

NO. OF OBS: 243

MAX WIND SPEED: 28 KNOTS DIRECTION: 200 DEG DAY: 24 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 132

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		21.2	53.0	21.2	2.3	1.5			2.3M	6.8M (10 00)

FEBRUARY DATA SUMMARY 46012
AVERAGE LATITUDE 37.4N AVERAGE LONGITUDE 122.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.9	(25 09)	12.4	17.7	(22 00)	222	28
SEA TEMP (DEG C)	12.7	(28 21)	13.1	14.0	(23 00)	222	28
AIR-SEA TEMP (DEG C)	-04.9	(25 09)	-00.7	04.5	(22 00)	222	28
PRESSURE (MBAR)	1007.4	(24 17)	1019.7	1028.8	(01 18)	222	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.8	11.3	4.1	.9			18.0	9.2
NE	.5	3.2	2.7				6.4	9.9
E	.9	4.5					5.4	6.4
SE	1.4	4.5	6.8				12.6	11.2
S	1.4	6.8	5.0				13.1	9.2
SW		2.7	1.8				4.5	9.4
W	1.4	2.3	1.8				5.4	8.8
NW	2.3	11.7	18.9	.9			33.8	10.8
CALM	.9						.9	.0
TOTAL	10.4	46.6	41.0	1.8			100.0	9.8

NO. OF OBS: 222

MAX WIND SPEED: 24 KNOTS DIRECTION: 340 DEG DAY: 20 HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 209

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		4.3	33.0	46.4	11.0	5.3			2.1M	4.5M (21 00)

JANUARY DATA SUMMARY 41003
AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.0	(02 12)	13.3	18.2	(07 03)	65	9
SEA TEMP (DEG C)	18.2	(02 06)	20.3	21.4	(08 15)	63	9
AIR-SEA TEMP (DEG C)	-11.6	(05 15)	-07.0	-01.6	(02 03)	63	9
PRESSURE (MBAR)	1010.6	(07 12)	1019.4	1028.4	(05 15)	60	9

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.1	20.3	7.8			31.3	16.9
NE								
E		3.1	1.6				4.7	10.0
SE			1.6				1.6	11.0
S		1.6	4.7	1.6			7.8	17.0
SW		1.6	3.1	1.6			6.3	15.8
W	1.6	7.8	14.1	3.1			26.6	14.4
NW		6.3	10.9	4.7			21.9	15.4
CALM								
TOTAL	1.6	23.4	56.3	18.8			100.0	15.4

NO. OF OBS: 64

MAX WIND SPEED: 31 KNOTS DIRECTION: 190 DEG DAY: 07 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 7

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	42.9	28.6	28.6						1.2M	2.5M (22 12)

FEBRUARY DATA SUMMARY 51001
AVERAGE LATITUDE 23.4N AVERAGE LONGITUDE 162.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.3	(18 19)	21.7	24.2	(17 03)	116	16
SEA TEMP (DEG C)	20.2	(23 15)	21.9	23.6	(17 03)	133	18
AIR-SEA TEMP (DEG C)	-03.0	(18 19)	-00.2	01.6	(19 15)	116	16
PRESSURE (MBAR)	1001.2	(11 15)	1016.4	1023.1	(28 21)	116	16

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.9	5.2	1.7			7.8	18.0
NE		3.4	37.1	4.3			44.8	16.6
E		.9	14.7				15.5	16.5
SE								
S		4.3	9.5				13.8	12.6
SW	.9	1.7	1.7	.9			5.2	12.0
W	.9	3.4	4.3				8.6	12.2
NW	.9	.9	1.7				3.4	8.8
CALM	.9						.9	.0
TOTAL	3.4	15.5	74.1	6.9			100.0	16.1

NO. OF OBS: 116

MAX WIND SPEED: 24 KNOTS DIRECTION: 040 DEG DAY: 22 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 123

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY			22.0	33.3	43.1	1.6			3.6M	6.5M (25 21)

JANUARY DATA SUMMARY 44005
AVERAGE LATITUDE 42.7N AVERAGE LONGITUDE 068.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-13.3	(05 06)	-03.0	06.3	(07 15)	135	26
SEA TEMP (DEG C)	04.2	(11 12)	08.4	09.5	(03 03)	159	28
AIR-SEA TEMP (DEG C)	-18.9	(05 06)	-08.6	00.9	(07 15)	125	24
PRESSURE (MBAR)	0994.1	(02 21)	1011.0	1025.0	(09 15)	125	24

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.6	5.7	4.1	2.5		13.9	21.9
NE		3.3	1.6	1.6			6.6	11.1
E		3.5	1.6				4.1	9.6
SE			3.3	2.5			5.7	20.3
S		1.6	2.5	3.3			7.4	18.9
SW		1.6	4.9				6.6	13.4
W		2.5	13.1	13.9	2.5		32.0	23.8
NW	.8	7.3	11.5	6.6	1.6		27.8	17.8
CALM								
TOTAL	.8	16.4	44.3	32.8	4.6		100.0	19.2

NO. OF OBS: 80

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		7.5	47.0	32.5	5.0	15.0			2.0M	6.5M (03 06)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 39.8% SEVERE: 1.7% #OBS: 118

Selected Gale and Wave Observations, North Atlantic

January and February 1981

Vessel	Nationality	Date	Position of Ship: Lat. deg.	Position of Ship: Long. deg.	Time GMT	Wind: Dir. 10s	Wind: Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C: Air	Temperature °C: Sea	Sea Waves*: Period sec.	Sea Waves*: Height ft.	Swell Waves: Dir. 10s	Swell Waves: Period sec.	Swell Waves: Height ft.
NORTH ATLANTIC OCEAN		JAN.															
BUYER	KCAO	1	36.9 N	53.7 W	12	24	25	> 25 NM	02	1014.2	21.2	20.0	4	39			
SEALAND PACER	KSLB	1	34.9 N	64.2 W	18	22	M 44	10 NM	01	1008.9	20.0	20.0	8	5	23	7	13
DYVI KATTEGAT	LMPR	3	38.0 N	58.6 W	00	22	M 44	10 NM	25	1008.0	10.0						
POSSEHL	HBRD	3	49.5 N	04.3 W	06	27	44	10 NM	02	1015.5	11.5						
NANTUCKET II	NNBN	3	40.7 N	69.2 W	09	29	M 42	5 NM	07	1015.0	- 1.0	7.0	5	10	28	9	18
POSSEHL	HBRD	4	47.2 N	08.3 W	00	27	44	5 NM	81	1019.0	12.1	11.7					
EXXON BALTIMORE	WHPK	5	32.6 N	74.0 W	00	36	45	2 NM	03	1013.5	13.0	21.1					
E. HORNSBY WASSON	GNUY	7	37.0 N	69.6 W	18	20	M 54	5 NM	63	1001.8	15.0	22.2	3	13	20	6	32.5
E. HORNSBY WASSON	GNUY	8	36.4 N	69.9 W	00	29	M 25	10 NM	15	1003.4	12.1	20.6	2	14.5	33	8	39
PEONIA	OXDN	8	38.5 N	39.1 W	12	05	M 48	5 NM	25	1020.0	15.0	18.0	9	16.5			
NANTUCKET II	NNBN	10	40.5 N	69.5 W	21	33	M 45	.25 NM	69	1008.5	1.0		4	10	34	6	19.5
CHERRY VALLEY	WIBK	11	32.2 N	71.2 W	00	33	44	10 NM	02	1010.5	11.7	17.7	2	8	32	8	6.5
NANTUCKET II	NNBN	11	40.5 N	69.5 W	01	30	M 45	2 NM	01	1010.8	2.2		4	8	30	6	19.5
MOEGH TRIGGER	LCHX	11	36.6 N	55.0 W	06	16	M 41	10 NM	02	1009.8	17.0	19.0		13	16	>13	26
DART EUROPE	ONDA	12	36.1 N	69.0 W	18	04	M 45	5 NM	02	1005.5	9.2	23.0	6	13	04	6	14.5
PEONIA	OXDN	12	52.8 N	08.2 W	18	33	M 50	10 NM	01	1016.2	5.8		4	10			
DART EUROPE	ONDA	13	36.2 N	70.0 W	00	36	M 46	5 NM	29	1004.3	5.0	20.0					
MOEGH TRIGGER	LCHX	13	38.9 N	66.8 W	00	02	M 55	5 NM	23	1006.0	8.0	16.0	11	23	02	11	23
NANTUCKET II	NNBN	13	40.5 N	69.5 W	12	34	M 41	2 NM	84	1008.5	- 3.2	5.1	2	5	04	< 4	11.5
AMERICAN ACE	KFCV	13	39.0 N	52.2 W	18	16	45	5 NM	02	1012.9	20.0	17.8	5	16.5	16	8	16.5
AMERICAN ACE	KFCV	14	39.7 N	50.7 W	00	14	45	5 NM	02	1016.4	18.9	17.8	5	19.5	14	8	19.5
BUILDER	KEXB	14	35.4 N	58.6 W	04	24	45	5 NM	02	1019.0	16.7	20.5	5	10	24	6	24.5
EXPORT PATRIOT	WCJY	14	36.5 N	14.5 W	06	03	41	5 NM	07	1035.0	12.2	16.7	3	11.5	03	7	16.5
AMERICAN ALLIANCE	KFEM	14	49.0 N	09.3 W	18	27	45	5 NM	03	1013.2	12.3	10.5	8	16.5	27	9	23
AMERICAN ALLIANCE	KFEM	15	48.4 N	10.8 W	00	32	50	5 NM	07	1014.0	11.1	11.2	6	19.5			
DELAWARE GETTY	KCBE	15	28.7 N	87.7 W	06	20	45	2 NM	67	1013.0	22.6	24.3	4	6	20	< 4	8
BUILDER	KEXB	15	36.3 N	48.3 W	18	23	50	5 NM	18	1019.0	14.5	19.5	4	10	23	6	19.5
AMERICAN ALLIANCE	KFEM	16	46.5 N	20.9 W	12	29	45	10 NM	02	1026.1	12.6	13.3	7	6.5	29	6	13
AMERICAN ALLIANCE	KFEM	17	46.6 N	29.5 W	12	21	50	5 NM	03	1016.5	13.9	14.9	6	6.5	21	7	11.5
SEALAND GALLOWAY	KHLX	17	49.2 N	08.5 W	12	30	42	10 NM	18	1013.0	10.0	10.0	9	16.5	32	12	18
TAMPA	JXNO	17	33.8 N	33.5 W	18	12	15	> 25 NM	02	1028.0	20.5	21.5	8	32.8			
USNS POWHATEN TATF 166	NHXR	18	30.6 N	64.3 W	16	28	M 50	2 NM	18	1003.0	13.4	21.1	5	13	28	>13	26
TILLIE LYKES	WDDP	18	29.8 N	61.3 W	18	28	55	5 NM	02	1003.7	16.7	21.1	5	10	28	11	14.5
AMERICAN ALLIANCE	KFEM	18	45.6 N	39.0 W	18	23	50	5 NM	01	1002.2	14.5	15.6	15	32.5			
AMERICAN ALLIANCE	KFEM	19	45.3 N	40.3 W	06	18	50	2 NM	80	0999.3	15.6	15.0	5	19.5			
SEALAND PACER	KSLB	19	36.5 N	62.5 W	12	18	M 42	2 NM	02	1006.5	18.9	17.8	5	8	20	8	19.5
USNS POWHATEN TATF 166	NHXR	19	30.8 N	64.9 W	16	30	50	10 NM	02	1010.0	15.6	20.8	3	8	29	12	32.5
STAR DOVER	LEQY	19	47.2 N	38.1 W	18	19	55	2 NM	62	1002.0	15.0						
STAR DOVER	LEQY	20	46.9 N	36.1 W	00	20	44	5 NM	80	1003.0	14.0						
DELAWARE II	KNBD	21	48.1 N	49.2 W	12	33	M 54	10 NM	02	1019.6	2.3	0.5	0	0			
USNS POWHATEN TATF 166	NHXR	22	34.0 N	70.9 W	04	26	M 50	2 NM	82	1000.0	17.7	18.9	3	6.5	26	9	49
DEFIANCE	KRPS	23	38.3 N	51.0 W	06	19	45	8 NM	07	0993.6	17.7	18.7	4	11.5	19	7	13
TFL EXPRESS	9VPU	28	48.1 N	29.5 W	06	33	M 55	10 NM	02	1000.3	10.0	13.0			32		
TFL EXPRESS	9VPU	29	47.5 N	39.3 W	06	22	M 50	5 NM	03	1014.0	15.5	14.5					
TFL EXPRESS	9VPU	30	48.9 N	49.1 W	06	29	M 70	5 NM	28	0989.6	1.5	2.4					
AMERICAN LEGACY	KFGJ	30	47.3 N	41.4 W	12	25	45	5 NM	81	0998.8	5.8	15.5	6	16.5	29	8	16.5
ZIM MONTREAL	4ZKM	31	44.0 N	39.0 W	12	27	55	5 NM	03	1009.0	15.0		3	3	27	8	11.5
DART EUROPE	ONDA	31	47.9 N	39.7 W	12	27	M 48	10 NM	02	0997.8	12.4	14.0	2	3	24	6	11.5
TFL DEMOCRACY	9VPR	31	49.9 N	39.0 W	18	24	M 47	10 NM	66	0997.5	6.5	9.0	10	16.5	26	12	26
Environmental Buoys																	
44005		02	42.7N	068.3W	21	28	M 46			996.1	-0.1	6.1	1	05			
44005		03	42.7N	068.3W	01	29	M 41			1000.9	-0.5	6.3	3	08			
		FEB.															
CHERRY VALLEY	WIBK	2	23.0 N	72.1 W	00	09	30	5 NM	02	1018.6	23.3	22.2	8	32.5	09	8	32.5
ADM WM M CALLAGHAN	KGYE	2	42.4 N	43.4 W	11	34	50	5 NM	07	1010.0	11.7	14.4	6	18	35	8	26
AMERICAN LEADER	KFEJ	3	49.6 N	07.5 W	12	27	28	10 NM	15	1015.8	10.0	8.3	4	8	27	< 4	41
CHASTINE MAERSK	DWCY	3	42.3 N	63.6 W	12	19	50	1 NM	63	1009.0	17.8		6	16.5	20	13	32.5
SEALAND LEADER	WSNH	3	39.2 N	69.0 W	12	18	M 45	5 NM	02	1010.5	17.0	16.0	6	10	18	6	10
TFL ITALY	JREL	6	41.5 N	58.8 W	12	33	M 45	5 NM	03	1017.5	7.0	16.0	4	8	33	7	10
DART EUROPE	ONDA	9	50.6 N	22 .0 W	18	33	M 45	5 NM	64	1021.2	9.5	12.0	8	19.5	29	8	19.5
TFL ITALY	JREL	10	49.2 N	19.6 W	18	02	M 45	5 NM	02	1034.0	12.0		5	6.5	34	9	13
AMERICAN ALLIANCE	KFEM	11	47.6 N	31.7 W	12	29	50	1 NM	18	1028.2	7.3	12.3	5	5	27	7	26
DART EUROPE	ONDA	11	47.8 N	38.8 W	12	28	M 51	10 NM	02	1036.6	5.0	14.0	6	10	26	8	19.5
LAKE TAHOE	SHHF	11	19.8 N	18.0 W	12	01	M 42	5 NM	60	1018.0	18.0	18.0	4	13	00		0
PIONEER CONTENDER	WMEC	11	46.3 N	31.4 W	18	30	45	10 NM	01	1033.0	13.3	12.2	8	16.5	32	11	32.5
TFL FREEDOM	9VXX	11	45.7 N	24.6 W	18	30	M 42	1 NM	02	1023.5	10.0	13.5	4	24.5			
AMERICAN ACCORD	KFEZ	11	47.1 N	26.2 W	18	30	45	5 NM	25	1021.0	8.4	12.7	5	19.5	28	7	32.5
TFL FREEDOM	9VXX	12	45.2 N	25.5 W	00	32	M 46	5 NM	01	1025.0	9.0	14.2	6	29.5			
AMERICAN ACCORD	KFEZ	12	47.6 N	28.4 W	06	30	50	5 NM	27	1024.0	5.5	12.7	5	19.5	30	7	32.5
AMERICAN ALLIANCE	KFEM	12	48.2 N	21.1 W	12	33	45	10 NM	18	1011.5	7.8	12.2	4	8	32	8	23
PIONEER CONTENDER	WMEC	12	45.8 N	24.6 W	12	32	45	5 NM	02	1016.5	6.7	12.8	NR	19.5	29	9	42.5
NANTUCKET II	NNBN	12	40.5 N	69.5 W	12	30	M 30	5 NM	42	1022.0	4.5		3	10.5	23	< 6	32.5
ORE MERIDIAN	SLZI	12	19.2 N	48.2 W	12	07	45	5 NM	03	1021.3	22.5	27.8	10	32.5			
ORE MERIDIAN	SLZI	13	20.0 N	47.5 W	00	07	41	5 NM	02	1022.0	23.5	27.8					
PIONEER CONTENDER	WMEC	13	47.6 N	22.2 W	06	34	34	5 NM	02	1013.3	6.2	11.7	7	16.5	34	>13	36
DEL MONTE	WNVM	13	12.8 N	74.1 W	12	05	45	5 NM	02	1014.8	26.0	26.0	10	19.5	05	6	19.5
DEL MONTE	WNVM	14	11.2 N	75.4 W	06	05	45	10 NM	02	1006.8	23.8	27.6					
DEL MONTE	WNVM	17	27.4 N	70.9 W	06	07	45	10 NM	02	1023.4	19.4	23.3					
ANTONIA JOHNSON	SEDT	18	28.3 N	46.1 W	18	30	35	10 NM	02	1010.5	20.0	28.8			34	8	32.5
NORMACSUN	WMBK	20	37.8 N	71.2 W	18	14	50	.25 NM	65	1002.1	16.5	16.5	7	16.5	16	12	19.5
TFL EXPRESS	9VPU	20	45.8 N	48.5 W	18	04	M 45	10 NM	01	1025.6	11.0	2.0	5	3	03	6	9
AMERICAN LEADER	KFEJ	21	47.6 N	42.4 W	12	05	50	5 NM	02	1017.1	10.0	13.3	4	10	06	>13	16.5
AMERICAN ARGOSY	KFCX	21	44.4 N	43.5 W	12	05	60	.25 NM	65	0999.5	7.2	6.9	5	10	05	12	44
TFL EXPRESS	9VPU	21	46.4 N	42.7 W	18	05	M 55	1 NM	07	1010.7	10.5	12.3	9	18	04	12	29.5
TFL EXPRESS	9VPU	22	46.6 N	41.0 W	06	08	M 50	2 NM	02	1010.6	15.0	14.0					
OLEANDER	PJVG	25	35.9 N	68.5 W	18	29	45	10 NM	02	1001.5	13.8		5	8	30	9	13
OLEANDER	PJVG	26	36.6 N	69.4 W	12	29	50	2 NM	81	0994.8	12.0		8	13	30	10	19.5
DAVID D. IRWIN	KPEA	26	36.7 N	74.6 W	13	34	37	10 NM	02	1011.2	5.0	4.8	5	32.5			
SEALAND PRODUCER	WJBJ	27	36.5 N	70.1 W	00	35	49	2 NM	60	1012.0	12.2	17.3	3	8	35	9	16.5
OVERSEAS MARILYN	WFGB	28	48.7 N	21.1 W	00	29	M 60	5 NM	68	0999.0	8.2	11.3			30	>13	49
TFL DEMOCRACY	9VPR	28	49.7 N	22.7 W	00	30	M 45	2 NM	62	0995.0	8.3	11.0					
LASH ATLANTICO	WEZU	28	36.3 N	29.5 W	12	33	10	10 NM	01	1016.9	15.6	16.1	3	32.5	33	< 6	10
SEALAND RESOURCE	WJKD	28	47.9 N	17.5 W	12	30	45	10 NM	02	0996.5	8.6	9.5	6	19.5	29	8	19.5

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Selected Gale and Wave Observations, North Pacific

January and February 1981

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		JAN.															
PRESIDENT TAFT	WLDT	1	55.3 N	155.8 W	00	14	N 45	5 NM	15	0998.9	4.5	5.6	4	10	14	6	13
PRINCE WILLIAM SOUND	WSDX	1	60.0 N	146.2 W	00	12	N 45	2 NM	81	1002.8	6.7	6.7	5	16.5	12	8	19.5
EXXON PHILADELPHIA	WNFJ	1	50.8 N	134.7 W	00	13	N 44	5 NM	03	1017.6	10.5	9.0	2	5	13	12	13
KEYSTONE CANYON	KSFK	1	59.6 N	145.2 W	00	18	45	2 NM	02	1003.2	6.7	4.4	9	14.5	18	9	14.5
VELMA LYKES	KVMU	2	33.0 N	124.9 E	00	33	45	5 NM	70	1022.5	2.8	15.3	6	16.5	33	8	19.5
MANULANI	KNIJ	2	31.1 N	130.2 W	06	16	42	5 NM	62	1010.7	18.9	17.8	5	10	XX		
CRYSTAL STAR	DSTG	2	38.6 N	142.8 E	06	13	N 44	2 NM	07	0992.0	10.0	11.0	11	10	13	6	10
PAN IVORY	D7GY	2	38.9 N	138.8 E	12	26	N 56	1 NM	24	0996.0	6.0	12.0			26		
PAN IVORY	D7GY	3	38.2 N	134.2 E	00	27	N 46	200 YD	24	0994.5	1.0	12.0			27		
PACMERCHANT	SMCB	3	33.2 N	151.4 E	00	26	N 48	10 NM	40	1004.5	18.0	20.0	5	5	19	7	18
OJI GLORIA	SLTW	3	52.8 N	167.7 W	00	04	N 44	2 NM	04	0985.0	3.0	5.0	8	11.5	04	12	14.5
SAMUEL S	SLWX	3	29.5 N	177.5 W	00	25	N 60	5 NM	03	1004.0	17.0	19.0	5	10	25	8	19.5
ROSE CITY	WGJP	3	34.5 N	149.3 W	00	17	45	2 NM	61	1001.0	16.1	12.2	6	10	31	12	11.5
SEATRAIN CHESAPEAKE	DSQC	3	46.6 N	172.3 W	05	31	N 43	5 NM	02	0982.0	2.5	3.0	7	23			
WESER EXPRESS	DLDE	3	34.9 N	151.5 E	06	28	44	5 NM	15	0999.5	16.5	20.8	9	14.5	27	12	18
SOUTH EXPRESS	ABWR	3	40.0 N	157.2 E	06	14	N 50	5 NM	02	0995.0	9.0	11.0	8	8	14	8	13
YOUNG SCOPE	6ZLH	3	39.8 N	148.3 E	06	29	N 41	5 NM	02	0991.5	8.0	15.0	5	10	27	8	13
SEATRAIN CHESAPEAKE	DSQC	3	46.7 N	173.6 W	11	31	N 49	.5 NM	07	0974.3	1.0	3.0			32	< 6	36
PACIFIC VENTURE	HOVS	3	37.8 N	144.1 E	12	26	N 42	2 NM	26	0993.0	8.0	12.0	6	14.5	26	10	26
SEALAND MARINER	KGJF	3	53.9 N	173.6 W	18	01	50	.5 NM	59	0974.0	2.0	3.0	5				
SHUNWIND	ELTQ	3	48.4 N	143.1 W	18	14	N 48	5 NM	02	0998.0	7.5	8.0	5	8	14	6	13
AMUR CAREER	3EXO	3	50.9 N	171.1 W	18	30	N 47	1 NM	26	0976.5	1.0	5.0	7	10	31	10	11.5
HANJIN POHANG	D8ON	4	49.1 N	154.4 W	00	24	N 48	10 NM	02	0998.0	9.0	9.0	7	16.5	24	7	13
AMUR CAREER	3EXO	4	50.8 N	167.8 W	06	30	N 46	1 NM	26	0977.0	4.0	5.0	5	8	29	8	10
STAR HONGKONG	ZCKP	4	42.2 N	177.4 E	06	10	N 45	5 NM	62	0973.8	9.0		8	13	XX		11.5
MANULANI	KNIJ	4	25.2 N	148.9 W	06	27	50	5 NM	65	1013.8	23.9	23.3	5	6.5	29		14.5
SILVERLIME	H3PF	4	37.1 N	146.8 W	18	24	N 41	10 NM	02	0998.5	14.0	12.0		14.5	24	6	14.5
SAMOA	OXTZ	4	43.6 N	169.9 W	18	18	N 41	5 NM	91	0994.5	9.0	8.5	5	10	36	8	5
VAN TRIUMPH	6ZJP	4	43.6 N	171.0 W	18	15	N 44	2 NM	03	0998.2	6.0	8.5					
BLESS RIVER	DSBS	4	33.8 N	178.1 E	23	24	N 35	.5 NM	65	0991.5	15.0	14.0	6	10	23	7	34.5
SAMUEL S	SLWX	5	29.0 N	174.3 E	00	23	N 45	5 NM	21	1001.0	19.0	19.0	7	8	23	7	11.5
PACMERCHANT	SMCB	5	33.2 N	166.0 E	00	26	N 50	10 NM	03	0995.8	14.0	18.0	8	16.5	29	>13	26
ALATOM STAR	H3LI	5	33.7 N	175.8 E	00	26	N 42	10 NM	01	0989.0	17.0						
SAMOA	OXTZ	5	44.3 N	166.1 W	06	17	N 47	1 NM	61	0984.0	11.0	8.0	6	14.5			
SANKOGRAIN	SLRS	5	37.2 N	176.0 E	12	24	N 50	1 NM	60	0985.0	10.0	15.0	8	8	26	13	16.5
BLESS RIVER	DSBS	5	34.0 N	176.6 W	18	25	N 45	2 NM	03	0995.0	14.0	12.0	6	11.5	26	7	29.5
ITALY MARU	JIBX	5	38.7 N	161.5 W	18	19	N 43	2 NM	58	0989.6	14.0	12.5	6	11.5	16	6	11.5
ITALY MARU	JIBX	6	38.8 N	159.5 W	00	19	N 45	2 NM	25	0987.0	16.0	13.0	6	11.5	19	8	19.5
CHIBA	5MGN	6	36.0 N	170.5 W	00	20	N 45	10 NM	01	0993.0	15.0		6	16.5	27	7	19.5
SAMUEL S	SLWX	6	28.7 N	171.6 E	00	29	N 52	10 NM	03	1009.0	20.0	21.0	4	6.5	29	7	16.5
OLGA MAERSK	OUXW	6	50.2 N	162.9 E	00	29	40	10 NM	86	0998.3	0.0				29	12	32.5
EASTERN DIAMOND	HODT	6	54.3 N	163.0 W	02	10	N 48	2 NM	01	0979.5	4.0	5.0	5	14.5	10	< 6	16.5
IKAN KERISI	9VKG	6	54.3 N	161.6 W	06	10	N 50	5 NM	21	0997.4	5.0		12	32.5	09	13	32.5
BLESS RIVER	DSBS	6	34.0 N	173.2 W	06	23	N 32	2 NM	01	1000.5	15.0	12.0	6	10	27	7	32.5
STREAM BOLLARD	ELYM	6	38.9 N	151.8 W	06	18	N 45	1 NM	63	0998.0	13.0	13.0	8	14.5	20	8	16.5
GREAT OCEAN	JKJT	6	40.0 N	163.5 W	06	27	N 43	5 NM	03	0984.0	11.0	11.0	6	10	27	6	10
FRIENDSHIP	ELXP	6	39.3 N	150.0 W	12	19	N 52	.5 NM	41	0992.5	14.0	14.0	6	29.5	18	6	24.5
BLESS RIVER	DSBS	7	34.0 N	167.9 W	00	29	N 28	10 NM	02	1007.4	12.0	14.0	6	10	28	11	32.5
IKAN KERISI	9VKG	7	54.2 N	172.8 W	05	27	N 45	5 NM	07	0997.0	5.0		7	8	29	11	8
PRESIDENT GRANT	WEZD	7	41.8 N	169.1 E	06	34	N 49	2 NM	40	0980.2	3.0	5.6	2	3	34	6	6.5
STAR HONGKONG	ZCKP	7	42.8 N	159.0 W	06	29	N 43	10 NM	01	0992.3	6.0		6	8			
SEATRAIN CHESAPEAKE	DSQC	7	38.0 N	149.9 E	11	27	N 47	.5 NM	95	1003.0	3.0	14.0		16.5	27	< 6	28
NEPTUNE DIAMOND	9YYT	7	53.9 N	174.9 W	12	26	N 41	10 NM	02	0976.0	1.0		4	10	26	7	11.5
OVERSEAS JUNEAU	WWND	7	53.6 N	136.9 W	12	14	42	5 NM	02	0996.5	7.8	5.5					
EASTERN DIAMOND	HODT	7	54.4 N	174.7 W	14	27	N 45	5 NM	02	0977.0	1.0	4.0	4	13	27	< 6	16.5
FRIENDSHIP	ELXP	7	38.1 N	139.0 W	18	19	N 43	2 NM	12	0997.0	16.0	17.0	5	11.5	18	10	13
GREAT OCEAN	JKJT	7	42.2 N	151.5 W	18	31	N 44	1 NM	12	0990.0	7.0	10.0	6	8	31	6	10
ITALY MARU	JIBX	8	38.6 N	140.5 W	00	26	N 41	10 NM	01	0994.0	15.0	15.0	4	6.5	21	8	11.5
STREAM BOLLARD	ELYM	8	38.9 N	140.9 W	00	20	N 44	10 NM	03	0992.5	14.0	15.0	7	13	23	8	19.5
GREAT OCEAN	JKJT	8	41.7 N	147.2 W	06	30	N 50	10 NM	64	0994.0	7.0	11.0	8	11.5	30	6	11.5
STAR HONGKONG	ZCKP	8	42.7 N	151.1 W	06	32	N 43	10 NM	01	0998.8	6.5		7	10	28	8	11.5
TYSON LYKES	WSCJ	8	31.4 N	147.5 E	06	30	32	10 NM	02	1011.2	13.9	17.8	5	16.5	29	7	32.5
SAMOA	OXTZ	8	48.0 N	143.9 W	06	04	N 45	5 NM	62	0983.5	9.0	8.0	5	8			
VAN TRIUMPH	6ZJP	8	49.2 N	144.3 W	12	35	N 50	1 NM	65	0970.0	6.0	8.5					
PORTLAND	WNDF	8	52.4 N	134.0 W	18	11	N 50	5 NM	63	0993.0	7.7	7.7	9	13	13	11	26
EXXON NEW ORLEANS	WNDM	8	53.2 N	137.3 W	18	10	N 45	2 NM	61	0985.8	8.0	8.3	4	13			
SEALAND DEVELOPER	KHRH	8	34.9 N	149.8 E	18	28	N 45	10 NM	87	1009.0	9.5	19.0	4	6.5	29	10	10
CHEVRON WASHINGTON	KFDB	8	46.6 N	134.1 W	18	17	N 48	5 NM	07	0985.5	10.0		2	6.5	18	< 6	11.5
KEIYO	JKHQ	8	47.5 N	134.1 W	21	17	N 48	2 NM	48	0979.0	8.5	11.0	6	14.5	17	7	19.5
EASTERN PACIFIC	JLVS	8	50.7 N	177.1 W	21	07	N 48	< 50 YD	26	0987.7	3.0	3.0	9	16.5	29	8	16.5
EASTERN WORLD	ELVA	8	49.0 N	134.6 W	23	16	N 50	1 NM	05	0997.7	10.0	8.9	6	21	16	9	36
BLESS RIVER	DSBS	9	34.2 N	153.9 W	00	23	N 25	1 NM	03	1005.5	15.0	12.0	6	11.5	23	7	32.5
SAMUEL S	SLWX	9	27.5 N	159.1 E	00	32	N 46	10 NM	03	1013.0	19.0	23.0	7	8	32	10	16.5
GREAT LAND	WFDP	9	54.2 N	136.5 W	00	09	N 42	2 NM	63	0982.6	8.3	7.7	5	13	09	6	14.5
KEIYO	JKHQ	9	47.6 N	133.5 W	00	21	N 48	2 NM	02	0983.5	8.5	11.0	6	14.5	21	8	16.5
SOHIO INTREPID	KACK	9	49.1 N	134.5 W	00	19	45	5 NM	15	0976.6	8.8	10.5	4	11.5	19	6	21
KEYSTONE ACE	WBAD	9	49.6 N	133.2 W	00	17	N 60	1 NM	60	0979.0	1.0						
CHEVRON WASHINGTON	KFDB	9	45.9 N	133.2 W	00	20	N 60	5 NM	02	0984.3	10.6		3	14.5	20	8	41
SEALAND DEVELOPER	KHRH	9	34.9 N	152.2 E	00	26	N 50	10 NM	02	1007.5	14.0	19.0	4	3	29	10	13
EXXON BENICIA	KPKL	9	48.9 N	133.2 W	00	16	43	2 NM	63	0979.0	8.3	11.7	12	16.5	20	>13	23
TONSINA	KJDG	9	51.1 N	135.4 W	06	22	45	2 NM	52	0982.5	10.0	6.7	9	19.5	22	12	19.5
YAMASHIN MARU	JBES	9	46.3 N	137.6 W	06	22	N 43	5 NM	07	1003.0	10.0	11.0	4	14.5	25	10	29.5
SAMOA	OXTZ	9	48.0 N	138.6 W	06	25	N 50	1 NM	60	0992.3	9.3	9.0	4	10	25	8	13
ZIM HONGKONG	4XLR	9	47.5 N	174.7 W	06	27	60	5 NM	07	0974.0	7.0	2.0	5	26	27	< 6	26
SANKOGRAIN	SLRS	9	41.8 N	151.5 W	18	23	N 47	5 NM	50	0981.5	8.5	10.0	11	8.5	23	12	10
STAR HONGKONG	ZCKP	9	42.0 N	139.7 W	18	19	N 47	5 NM	63	0998.2	12.5		9	8.5	19	11	16.5
STAR HONGKONG	ZCKP	10	41.7 N	138.6 W	00	18	N 46	5 NM	62	0999.8	13.0		7	10	17		16.5
SANKOGRAIN	SLRS	10	42.1 N	149.4 W	00	25	N 56	1 NM	81	0984.1	8.3	10.0	7	5	25	11	11.5
SOUTH EXPRESS	ABWR	10	41.1 N	147.9 W	00	24	N 55	10 NM	03	0990.0	11.0	11.0	12	32.5	24	12	24.5
PERENNIAL ACE	HOMQ	10	38.9 N	174.3 E	03	26	N 47	5 NM	27	0994.5	8.5	14.0	7	11.5	29	9	16.5
TONSINA	KJDG	10	48.3 N	132.6 W	06	16	45	2 NM	63	1005.2	11.7	8.3	10	19.5	16	12	19.5
JAPAN ACE	JKFS	10	45.2 N	133.1 W	12	17	N 43	5 NM	03	1006.0	13.0	12.0	4	6.5	26	8	13
SILVERLIME	H3PF	10	33.6 N	172.5 W	18	33	N 48	10 NM	02	1004.0	18.0	12.0		11.5	23	7	11.5
SILVERLIME	H3PF	11	33.7 N	173.7 W	00	33	N 48	10 NM	02	1007.0	21.0	12.0		11.5	33	7	11.5

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.	
NORTH PACIFIC OCEAN		JAN.																
SAMUEL S	SLHX	11	28.2 N	149.9 E	00	27	N 45	5 NM	03	1005.0	20.0	21.0	4	8	27	7	14.5	
PRINCE WILLIAM SOUND	WSDX	11	14.8 N	95.8 W	00	03	N 45	10 NM	00	1006.5	26.7	28.9	3	14.5	03	< 6	21	
DAFFODIL	H3AG	11	38.7 N	171.7 E	18	24	N 41	10 NM	01	0983.0	15.0	15.0	7	14.5	26	8	13	
MATSONIA	KWRC	11	32.5 N	137.6 W	18	20	36	5 NM	07	1001.6	17.7	17.8	2	14.5	20	6	32.5	
ARIES	KGBD	12	11.5 N	128.3 E	00	05	N 41	5 NM	01	1009.9	25.0	26.7	4	18	04	< 6	16.5	
SILVERLIME	H3PF	12	33.7 N	178.5 W	00	23	N 46	10 NM	02	0999.0	20.0	12.0		10	23	7	11.5	
IRIS ISLAND	JPKS	12	53.1 N	139.1 W	00	27	N 06	5 NM	03	1008.0	7.0	7.0	5	6.5	27	8	32.5	
MARIA TOPIC	SMPS	12	31.1 N	148.5 W	00	28	45	5 NM	01	0996.0	19.5	21.0	7	10	28	12	11.5	
SOUTH EXPRESS	ABWR	12	34.7 N	134.2 W	00	15	N 45	2 NM	03	0999.0	10.0	14.0	12	26	15	>13	19.5	
WISTERIA	JJRD	12	46.3 N	142.2 W	12	04	N 42	2 NM	44	0983.0	9.0	7.0	6	11.5	04	7	10	
SEALAND DEVELOPER	KMRN	12	40.6 N	172.5 W	12	18	N 46	5 NM	63	0998.0	10.0	11.0	4	13	18	>13	19.5	
KASHU MARU	JJLL	12	47.9 N	138.8 W	18	18	N 50	1 NM	62	0980.5	8.0	10.0	4	11.5	15	9	19.5	
KASHU MARU	JJLL	13	48.9 N	141.2 W	00	20	N 43	2 NM	07	0980.5	8.0	10.0	5	11.5	17	9	19.5	
WISTERIA	JJRD	13	46.7 N	139.4 W	00	21	N 45	5 NM	18	0990.0	10.0	8.0	8	13	21	9	14.5	
SILVERLIME	H3PF	13	33.7 N	176.5 E	00	29	N 41	10 NM	02	1001.0	20.0	12.0		10	29	6	10	
SAMUEL S	SLHX	13	28.7 N	143.6 E	00	29	N 48	2 NM	44	1010.0	16.0	21.0	5	11.5	29	12	23	
B T ALASKA	WFQE	13	59.9 N	144.9 W	06	09	42	5 NM	02	0990.8	10.0	7.2	10	10	12	12	10	
PRESIDENT KENNEDY	KCAK	13	42.2 N	172.7 W	12	26	45	10 NM	02	0975.1	7.0	6.9	6	19.5	26	9	24.5	
MOBILE MERIDIAN	KGSN	13	54.6 N	135.7 W	18	14	40	5 NM	07	1003.4	10.0	9.6	5	20	18	9	36	
DAFFODIL	H3AG	13	41.4 N	173.2 W	18	27	N 55	2 NM	18	0981.0	8.5	10.5	11	19.5	27	8	14.5	
PORTLAND	WNDF	13	53.9 N	137.6 W	18	12	N 50	2 NM	63	0996.2	8.3	6.7	13	26				
EXXON NEW ORLEANS	WNDM	13	51.5 N	135.0 W	18	15	N 48	5 NM	24	0999.2	9.5	8.4	5	16.5				
TROPICANA	ABVM	13	33.0 N	145.0 W	18	19	N 42	1 NM	62	0999.0	18.0							
MAUNA-ILI	WNKP	13	36.6 N	143.4 W	21	18	N 51	2 NM	02	0988.5	16.7	16.7			19	10	29.5	
SAMUEL S	SLHX	14	28.4 N	140.5 E	00	32	N 55	5 NM	02	1014.0	13.0	22.0	7	16.5	32	10	16.5	
ARCO ANCHORAGE	WCIG	14	60.0 N	145.7 W	00	11	N 48	1 NM	02	1003.0	5.6	3.9	7	16.5				
DAFFODIL	H3AG	14	41.6 N	171.7 W	00	27	N 50	5 NM	05	0983.0	7.0	11.0	7	16.5	27	9	16.5	
MING MOON	BLMG	14	34.3 N	159.5 W	06	29	N 45	10 NM	03	1000.1	14.5	14.0	8	16.5	29	7	13	
TROPICANA	ABVM	14	32.2 N	147.3 W	06	26	N 44	.25 NM	44	0999.0	17.0							
ORIENTAL STATESMAN	ELRE	14	30.9 N	146.2 W	12	29	N 41	5 NM	25	1003.5	15.0	20.0						
PORTLAND	WNDF	14	52.2 N	133.1 W	12	14	N 42	5 NM	61	1005.8	8.9	8.4	10	11.5	17	10	14.5	
MOBILE MERIDIAN	KGSN	14	53.0 N	133.2 W	12	14	N 50	5 NM	02	1006.5	9.5	5.4	4	16.5	14	7	29.5	
EXXON NEW ORLEANS	WNDM	14	47.9 N	131.9 W	18	14	N 41	5 NM	07	1005.6	10.1	10.6	6	14.5				
SAN BLAS	DZNL	14	27.0 N	160.4 W	21	24	47	10 NM	02	1013.8	21.0	20.9						
EXXON NEW ORLEANS	WNDM	15	46.7 N	131.0 W	00	14	N 45	5 NM	02	1003.0	13.4	10.6	8	13	18	9	16.5	
EASTERN PACIFIC	WLVS	15	52.1 N	142.0 W	00	14	N 43	5 NM	02	0979.5	9.0	5.0	9	28	XX			
SILVERLIME	H3PF	15	33.8 N	165.0 E	06	33	N 48	5 NM	02	1000.0	15.0	13.0		13	33	6	13	
B T ALASKA	WFQE	15	55.8 N	142.0 W	06	18	34	5 NM	02	0984.5	10.4	5.0	10	29.5	15	10	32.5	
PRESIDENT KENNEDY	KCAK	15	42.2 N	152.7 W	12	26	50	10 NM	01	0981.0	7.8	8.3	8	16.5	29	11	32.5	
SILVERLIME	H3PF	16	33.5 N	161.5 E	00	33	N 48	2 NM	02	1010.0	12.0	13.0		13	33	8	13	
PACIFIC PEACE	H3VX	16	23.7 N	125.8 E	00	36	N 17	5 NM	03	1021.0	19.0	12.0	5	3	36	< 6	37.5	
TROPICANA	ABVM	16	29.0 N	154.8 W	00	22	N 41	5 NM	03	1006.8	22.0							
PRESIDENT TYLER	WEZM	16	35.9 N	147.7 E	06	17	N 42	10 NM	91	0999.5	11.7	16.2	7	6.5	11	7	11.5	
CHUEN ON	H3SX	16	34.2 N	145.9 W	12	23	N 41	5 NM	01	0997.5	17.0	16.0			23	7	19.5	
PRESIDENT KENNEDY	KCAK	16	40.6 N	111.3 W	18	23	56	2 NM	63	0972.7	9.0	11.1	7	19.5	23	10	21	
ADRIAN MAERSK	OYIT	16	38.3 N	153.7 E	18	13	45	2 NM	45	0995.0	5.8		10	19.5				
TROPICANA	ABVM	17	27.0 N	150.5 W	00	26	N 43	2 NM	62	1001.0	21.0							
MARCONA EXPORTER	ELEC	17	34.2 N	167.5 W	00	27	48	10 NM	02	0991.5	11.0	15.0	10	24	27	11	29.5	
PRESIDENT KENNEDY	KCAK	17	41.0 N	139.0 W	00	24	55	5 NM	07	0979.5	13.0	11.2	5	24.5	23	11	31	
SILVERLIME	H3PF	17	33.6 N	156.5 E	00	27	N 50	2 NM	02	1003.0	18.0	14.0		11.5	27	7	11.5	
PACIFIC VENTURE	WDVS	17	38.4 N	126.9 W	06	17	N 36	.5 NM	82	1004.5	15.0	15.0	8	34.5	17	10	32.5	
TOYOTA MARU 10	JNBI	17	36.5 N	171.8 W	06	28	N 51	2 NM	27	0990.5	11.0	12.0	8	14.5	31	10	29.5	
JAPAN APOLLO	JWZL	17	50.0 N	138.0 W	06	09	N 42	2 NM	61	0977.5	8.5							
ORIENTAL EXECUTIVE	DSAN	17	33.4 N	144.8 W	06	21	N 44	5 NM	02	0992.0	18.0							
ADRIAN MAERSK	OYIT	17	38.5 N	158.6 E	06	04	45	2 NM	60	0994.0	6.0		10	19.5				
PRESIDENT TYLER	WEZM	17	36.9 N	159.8 E	12	33	N 50	5 NM	02	1000.0	8.3	11.1	8	23	00		0	
ORIENTAL STATESMAN	ELRE	17	27.0 N	167.5 W	12	29	N 46	2 NM	02	1007.0	18.0	22.0						
SHUNWIND	ELIG	17	50.9 N	132.3 W	12	14	N 42	10 NM	48	0989.0	10.5	10.0	4	10	XX			
SKOUBORD	LIGN	17	34.9 N	158.8 E	12	35	45	10 NM	02	1011.5	18.0							
MANULANI	KNIJ	17	27.2 N	143.3 W	18	22	48	5 NM	07	0999.0	21.7	22.2	6	11.5	XX			
MAUNALEI	KSVE	17	26.4 N	152.6 W	18	27	50	10 NM	02	0999.7	20.6	23.9	4	8	27	>13	8	
GLOBAL FRONTIER	H3AU	17	29.0 N	162.3 W	18	29	N 48	.5 NM	07	1012.8	14.0	18.0	16	24.5	28	9	32.5	
STREAM BOLLARD	ELYM	17	16.0 N	95.0 W	18	35	N 42	10 NM	02	1013.0	24.0	23.0	6	6.5	35	6	6.5	
GREAT LAND	WFDP	17	54.8 N	138.0 W	18	13	N 42	2 NM	43	0981.2	10.0	7.2	3	5	11	< 6	8	
CRESSIDA	3FT8	18	53.1 N	137.3 W	00	19	N 43	5 NM	05	0984.8	9.0	12.5	7	16.5	19	7	13	
MARCONA EXPORTER	ELEC	18	34.2 N	161.2 W	00	29	41	10 NM	88	0993.5	11.5	16.8	8	19.5	29	10	23	
GLOBAL FRONTIER	H3AU	18	28.7 N	162.7 W	00	29	N 43	5 NM	01	1005.8	17.0	20.0	12	28	29	9	34.5	
MAUNALEI	KSVE	18	27.0 N	151.0 W	00	27	50	5 NM	02	0996.3	22.2	23.9	4	8	27	>13	10	
MANULANI	KNIJ	18	26.6 N	145.2 W	00	20	45	10 NM	24	0991.6	21.7	22.2	6	11.5	24	< 6	19.5	
MOBIL ARCTIC	KSPY	18	59.6 N	145.3 W	06	09	N 48	5 NM	07	0979.5	7.2	9.0	4	6.5	11	6	19.5	
MATSONIA	KWRC	18	23.6 N	152.7 W	06	29	30	10 NM	02	1009.0	21.1	23.3	3	16.5	29	7	32.5	
EXXON PHILADELPHIA	WNFJ	18	57.5 N	142.1 W	06	12	N 45	5 NM	48	0979.7	8.5	7.3	2	6.5	11	12	16.5	
PARALLA	SGNA	18	27.8 N	153.4 W	06	26	55	5 NM	02	1002.0	16.0							
SINALOA	GKNS	18	28.6 N	146.4 W	06	27	N 50	5 NM	29	0993.8	16.4	17.9	8	49				
ADRIAN MAERSK	OYIT	18	38.3 N	172.1 E	12	31	43	5 NM	02	1003.7	9.0		9	23				
AUSTRAL LIGHTNING	WEZA	18	26.5 N	146.7 W	12	27	45	5 NM	01	1003.4	20.6	22.2	10	19.5	28	12	23	
NEWARK	WNDG	18	51.2 N	130.3 W	12	14	45	5 NM	21	0993.9	8.9	7.8	5	16.5	14	9	24.5	
AMERICAN LIBERTY	WZJD	18	38.7 N	174.6 E	12	29	45	5 NM	02	1000.2	8.3	13.3	7	13	29	8	16.5	
BROOKS RANGE	WSPP	18	48.3 N	133.0 W	18	14	45	5 NM	02	0978.5	12.2	8.3	8	10	15	10	16.5	
B T ALASKA	WFQE	18	44.7 N	131.1 W	18	18	30	5 NM	02	0986.1	14.7	11.0	10	23	18	>13	26	
MANHATTAN	WJAF	18	51.3 N	130.9 W	18	14	45	2 NM	51	0990.3	11.1	9.4	5	8	15	9	24.5	
ARCO ANCHORAGE	WCIG	18	40.9 N	125.2 W	18	16	N 42	5 NM	02	1011.0	15.0	10.0	9	18	27	12	13	
MANHATTAN	WJAF	19	50.8 N	130.1 W	00	14	45	1 NM	02	0988.6	10.6	8.9	5	8	15	11	19.5	
B T ALASKA	WFQE	19	44.6 N	130.7 W	00	19	30	200 YD	46	0990.5	14.5	11.5	10	24.5	19	>13	29.5	
GREAT LAND	WFDP	19	49.6 N	127.6 W	00	14	N 44	2 NM	43	1002.5	13.4	11.1	4	14.5	14	6	13	
AMERICAN LIBERTY	WZJD	19	36.3 N	179.2 E	00	29	45	10 NM	01	1005.0	18.0	12.8	5	13	32	6	16.5	
TROPICANA	ABVM	19	27.3 N	167.0 W	00	24	N 50	2 NM	00	1001.0	20.0							
ASIA INDUSTRY	ABGI	19	41.7 N	127.0 W	00	26	N 45	2 NM	02	1004.0	16.0	14.0	9	13	16	9	14.5	
MANULANI	KNIJ	19	24.4 N	149.4 W	00	23	30	10 NM	02	1005.9	24.4	22.8	6	8	27	7	36	
MAUNALEI	KSVE	19	29.5 N	145.0 W	00	29	42	10 NM	02	1003.7	16.7	21.1	4	8	27	>13	10	
CHUEN ON	H3SX	19	34.0 N	160.5 W	06	25	N 40	1 NM	03	0977.5	13.0	14.0	8	11.5	25	8	24	
EVER SHINE	WPET	19	33.1 N	163.4 W	06	27	N 45	5 NM	05	0984.0	14.0	15.0	5	11.5	27	6	11.5	
NEWARK	WNDG	19	50.1 N	129.3 W	06	14	45	2 NM	62	1002.0	9.4	8.9	5	16.5	14	9	24.5	
PARALLA	SGNA	19	32.4 N	150.5 W	06	22	45	5 NM	44	0986.0	14.0							

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		JAN.															
GLOBAL FRONTIER	H3AU	19	28.6 N	167.0 W	12	31	M 50	1 NM	03	1006.5	16.5	19.0	9	31	31	9	32.5
TOYOTA MARU 10	JKBI	19	37.4 N	155.9 W	18	35	M 52	2 NM	07	0980.5	10.5	11.0	9	23	01		24.5
CHARLES LYKES	KLHR	19	38.5 N	150.7 W	18	36	48	2 NM	63	0962.0	8.9	8.9	6	16.5	07	>13	16.5
MATSONIA	KHRC	19	28.7 N	142.5 W	18	22	36	5 NM	03	0997.7	20.6	19.4	3	16.5	22	9	32.5
SINALOA	OXNS	19	27.6 N	151.9 W	18	26	M 60	200 YD	02	0995.0	20.4	18.1	9	32.5	26	>13	46
MAUI	WSLH	19	30.3 N	142.1 W	18	19	M 54	5 NM	02	0990.5	19.4	18.3	6	28	28	9	23
AMELIA TOPIC	SMRW	19	30.4 N	154.4 W	18	27	45	.5 NM	02	0988.0	15.0	18.0	6	24.5	00		0
SINALOA	OXNS	20	27.4 N	152.3 W	00	29	M 60	10 NM	02	0998.1	20.0	19.6	9	46			
MATSONIA	KHRC	20	29.6 N	140.6 W	00	21	40	2 NM	03	1003.0	21.1	18.9	3	16.5	21	9	36
CHARLES LYKES	KLHR	20	38.2 N	148.6 W	00	11	45	2 NM	15	0957.0	8.1	8.9	6	16.5	07	>13	16.5
POTOMAC	NBLM	20	45.6 N	129.6 W	00	15	60	10 NM	05	0989.2	.	8.3	8	24.5	15	10	49
CHUEN ON	H3BX	20	33.4 N	164.0 W	06	30	M 48	5 NM	03	1007.0	12.0	14.0	8	13	30	8	26
MAUI	WSLH	20	29.5 N	143.7 W	06	25	M 65	5 NM	15	0992.0	17.2	19.4	6	65.5	31	8	24.5
WORLD CANDOUR	SMOI	20	41.8 N	134.8 W	06	14	M 50	1 NM	59	0979.0	14.9	16.0	9	19.5			
MARCONA EXPORTER	ELEC	20	34.2 N	145.1 W	12	29	50	10 NM	02	0988.5	12.0	15.0	10	26	29	12	29.5
HIEI MARU	JDOC	20	45.8 N	132.5 W	12	17	M 43	1 NM	61	0986.0	12.0	11.0	3	6.5	16	7	16.5
MAUNALEI	KSVE	20	36.7 N	137.3 W	12	23	47	5 NM	62	0975.6	15.6	17.2	4	8	20	12	13
VICTORIOUS	3FYC	20	46.0 N	128.6 W	16	12	M 50	1 NM	81	0995.0	8.0						
BROOKS RANGE	WSRP	20	43.2 N	128.1 W	18	14	55	5 NM	63	0993.0	14.4	11.7	8	13	18	>13	19.5
PARALLA	SGNA	20	37.3 N	146.5 W	18	30	60	10 NM	16	0978.5	9.1						
KOREAN LEADER	D7XX	20	40.0 N	127.4 W	18	17	M 45	.5 NM	02	0998.0	15.8	14.0	7	16.5	17	11	19.5
PACSTAR	6ZFW	20	52.3 N	143.1 W	18	05	M 45	1 NM	61	0982.0	- 2.0	7.0	6	10	06	11	13
VAN TRIUMPH	6ZJP	20	50.6 N	130.3 W	18	12	M 42	1 NM	50	0997.0	11.0	10.0					
MOBIL ARCTIC	KSPY	20	52.7 N	137.4 W	18	08	M 45	5 NM	07	0986.1	7.2	5.5	4	8	09	6	16.5
EXXON BENICIA	KPKL	20	48.7 N	133.1 W	18	14	55	2 NM	62	0977.7	11.1	10.6	6	5	14	12	11.5
JAPAN AMBROSE	JDXW	20	38.2 N	152.1 W	18	31	M 44	10 NM	02	0997.0	6.0	14.0	9	16.5	31	11	18
CORNUCOPIA	KPJC	20	48.5 N	129.9 W	21	14	48	2 NM	62	0986.2	10.0	11.7	2	6.5	14	7	11.5
SOVEREIGN VENTURE	ELDQ	20	34.6 N	171.4 E	23	20	M 45	10 NM	03	0999.0	16.3	19.0	8	5	21	11	13
MARCONA EXPORTER	ELEC	21	34.2 N	142.5 W	00	27	50	10 NM	02	0996.8	14.0	15.0	10	29.5	27	12	29.5
VAN TRIUMPH	6ZJP	21	51.3 N	132.2 W	00	12	M 60	.5 NM	55	0981.1	10.0	9.5					
PACSTAR	6ZFW	21	52.3 N	144.9 W	00	05	M 43	1 NM	61	0967.0	- 2.0	7.0	6	11.5	05	11	16.5
PARALLA	SGNA	21	37.7 N	146.3 W	00	30	60	10 NM	03	0978.5	6.0						
SANSINENA II	WSTN	21	53.5 N	142.6 W	00	05	45	1 NM	63	0970.2	5.6	4.4	8	24.5	13	10	24.5
AMERICA SUN	WNEJ	21	54.9 N	139.7 W	00	09	M 50	2 NM	02	0980.0	8.2	6.1	5	16.5	09	7	18
CORNUCOPIA	KPJC	21	48.5 N	129.9 W	00	15	50	2 NM	62	0984.5	10.6	11.7	2	6.5	14	7	11.5
CHARLES LYKES	KLHR	21	38.1 N	139.6 W	00	27	45	5 NM	16	0986.0	11.1	10.0	6	11.5	27	12	16.5
MOBIL ARCTIC	KSPY	21	52.0 N	137.0 W	00	09	M 55	2 NM	07	0971.9	8.9	9.6	3	11.5	13	< 6	41
MAUNALEI	KSVE	21	38.8 N	134.1 W	00	25	51	5 NM	62	0988.1	14.4	15.6	4	8	23	12	14.5
CHEVRON WASHINGTON	KFDB	21	44.3 N	125.0 W	00	17	M 42	10 NM	61	1001.8	15.6		4	5	19	6	14.5
KEYSTONE ACE	H8AD	21	51.7 N	136.2 W	00	15	M 52	.25 NM	53	1012.0	9.0						
EXXON SAN FRANCISCO	KAAC	21	55.5 N	144.1 W	00	04	45	2 NM	63	0985.5	4.5	5.0	6	11.5	03	< 6	24.5
GLACIER BAY	KACF	21	51.7 N	131.3 W	00	13	55	5 NM	62	0986.8	9.4	6.6	6	31	14	8	31
POTOMAC	NBLM	21	45.2 N	129.6 W	02	16	60	10 NM	01	0998.8	14.0	12.0	8	24.5	10	10	41
PERENNIAL ACE	HOMQ	21	54.0 N	149.8 W	03	36	M 52	2 NM	63	0984.3	4.4	5.0			05	9	16.5
VIENNA WOODS	SLOT	21	36.3 N	156.0 E	05	29	M 50	5 NM	68	0999.0	9.0	16.0	10	14.5	29	12	19.5
WORLD CANDOUR	SMOI	21	40.8 N	132.8 W	06	20	M 43	2 NM	97	0994.8	33.0	16.0	8	23	20	9	23
TRIUMPH	3EZZ	21	43.7 N	150.8 W	06	34	M 45	2 NM	02	0988.0	3.0	5.0	10	16.5	34	10	16.5
WESER EXPRESS	DLDE	21	50.3 N	129.4 W	06	14	50	2 NM	15	0994.0	12.0	11.0					
KEIYO	JKMQ	21	54.8 N	147.5 W	06	01	M 60	50 YD	65	0974.5	1.0	6.0	7	11.5	02	7	14.5
ORIENTAL MERCHANT	VRCS	21	52.0 N	149.2 W	09	35	M 55	1 NM	61	0969.0	2.0	4.0					
SARGODHA	OUIU	21	46.6 N	178.6 E	12	07	M 58	1 NM	64	0974.4	3.0	10.0	4	19.5			
ARCO FAIRBANKS	WGWB	21	56.1 N	140.5 W	12	12	M 44	5 NM	25	0997.2	7.5	4.4	4	10	10	10	16.5
AMUR CAREER	3EXQ	21	54.2 N	140.3 W	12	13	M 42	5 NM	02	0973.6	9.0	8.0	9	11.5	13	10	13
SUNNY PIONEER	H3SY	21	51.5 N	149.8 W	12	34	M 60	.5 NM	00	0970.8	2.5	2.0	8	29.5	34	8	29.5
EXXON PHILADELPHIA	WNFJ	21	51.4 N	138.1 W	18	14	M 55	2 NM	03	0983.7	12.0	10.0	2	5	13	10	32.5
PORTLAND	WNDF	21	56.8 N	149.4 W	18	32	M 50	2 NM	58	0974.5	1.9	6.1	6	10	34	10	19.5
BROOKS RANGE	WSRP	21	40.9 N	126.1 W	18	14	45	5 NM	65	1005.0	13.3	11.1	6	8	30	>13	19.5
THOMPSON PASS	WSRY	21	50.9 N	135.5 W	18	16	35	5 NM	21	0982.5	8.0	8.0	3	8	16	7	37.5
CHEVRON MISSISSIPPI	WKBR	21	48.9 N	139.6 W	18	18	45	10 NM	01	0972.2	7.5	6.7	6	10	15	12	19.5
PRESIDENT GRANT	WEZD	21	53.3 N	149.0 W	18	34	M 50	1 NM	63	0967.0	2.2	2.8	2	10	34	< 6	41
SEATRAIN ORISKANY	DSOM	21	39.0 N	127.0 W	18	14	M 44	2 NM	62	1001.0	15.0	14.0	5	24.5	XX		24.5
CRYSTAL STAR	DSTG	21	37.2 N	151.1 E	18	29	M 46	5 NM	03	0994.0	5.0	12.0	12	10	29	12	16.5
SKOUBORD	LION	21	38.0 N	171.1 W	18	18	42	5 NM	03	1005.0	12.5						
MATSONIA	KHRC	21	35.1 N	128.6 W	18	16	28	5 NM	62	1000.5	18.9	16.7	3	16.5	16	8	32.5
GRAND GLOBE	6ZON	21	49.3 N	150.7 W	22	32	M 41	> 25 NM	03	0991.2	3.5	7.0	2	1.5	31	12	26
PACSTAR	6ZFW	22	49.6 N	147.3 W	00	30	M 75	1 NM	08	0987.0	- 4.0	7.0	8	16.5	30	12	32.5
ASIA INDUSTRY	A8EI	22	51.3 N	144.6 W	00	30	M 53	10 NM	07	0970.0	7.0	7.0	8	16.5	30	9	19.5
SEATRAIN ORISKANY	DSOM	22	39.6 N	129.3 W	00	28	M 43	.5 NM	80	0992.5	12.0	14.0	7	19.5	27	>13	23
TIBER	A8WA	22	40.4 N	126.0 W	00	14	M 55	< 50 YD	46	1004.2	15.0	13.0	6	11.5	15	8	16.5
PRESIDENT GRANT	WEZD	22	53.5 N	150.4 W	00	32	M 50	1 NM	63	0975.5	1.7	2.8	2	10	34	6	29.5
ALEUTIAN DEVELOPER	WIPL	22	57.6 N	152.0 W	00	34	48	1 NM	71	0981.8	1.1	5.6	6	6.5	35	7	30
ORIENTAL MERCHANT	VRCS	22	52.9 N	153.8 W	00	32	M 45	5 NM	01	0989.0	4.0	3.0	6	10	32	8	32.5
EXXON NEW ORLEANS	WNDM	22	43.2 N	128.3 W	00	15	M 43	1 NM	63	0987.8	14.4	12.2	4	16.5	26	10	24.5
EXXON PHILADELPHIA	WNFJ	22	51.3 N	134.8 W	00	14	M 43	5 NM	03	0992.9	11.5	10.0	2	5	16	12	36
SEALAND ENDURANCE	KGJX	22	51.0 N	169.8 W	00	12	42	10 NM	02	0985.1	3.4	3.9	6	11.5	12	6	11.5
CHEVRON WASHINGTON	KFDB	22	41.3 N	125.0 W	00	17	M 58	5 NM	63	1001.6	15.6		6	6.5	18	8	18
SKOUBORD	LION	22	38.2 N	169.3 W	00	18	42	2 NM	64	1004.0	14.0						
MOBIL ARCTIC	KSPY	22	51.0 N	136.5 W	00	16	M 35	5 NM	03	0986.1	9.4	6.1	3	10	15	< 6	41
SUNNY PIONEER	H3SY	22	52.3 N	150.3 W	00	31	M 45	1 NM	00	0981.6	0.0	3.0	7	26	31	7	26
HIEI MARU	JDOC	22	51.8 N	147.5 W	00	30	M 55	.5 NM	69	0975.0	2.0	6.0	6	11.5	30	13	29.5
POTOMAC	NBLM	22	42.9 N	127.9 W	03	16	50	5 NM	02	0999.0	12.5	12.0	10	26			
VIENNA WOODS	SLOT	22	37.3 N	163.4 E	05	29	M 42	5 NM	50	0988.0	9.0	12.0	10	14.5	29	12	18
OCEANOGRAPHER	WTEP	22	44.7 N	125.5 W	06	17	M 51	5 NM	02	0999.3	12.8	11.0	5	11.5	20	7	19.5
SARGODHA	OUIU	22	44.6 N	177.0 W	06	30	M 45	1 NM	45	0960.0	4.5	10.0	4	26			
PRINCE OF TOKYO	A8BJ	22	49.9 N	170.2 W	06	08	M 46	50 YD	41	0970.0	1.0	4.0	9	29.5	08	7	29.5
CHEVRON CALIFORNIA	WCGN	22	30.1 N	139.5 W	12	33	45	> 25 NM	02	1020.5	15.0	16.7	3	6	28	>13	23
SKAUGRAN	LHUK	22	54.5 N	169.4 W	12	09	45	5 NM	03	0988.0	2.5		4	10			
GLACIER BAY	KACF	22	50.0 N	128.4 W	12	15	60	5 NM	20	0983.4	10.0	7.2	5	24.5	18	9	24.5
MARIA TOPIC	SMPS	22	30.4 N	160.2 E	12	29	56	2 NM	02	1005.5	12.0	18.0	9	11.5	27	12	13
EASTERN TREASURE	6ZSP	22	36.2 N	158.0 E	18	31	M 48	2 NM	26	1000.2	5.0	12.5	7	23	28	13	29.5
CRYSTAL STAR	DSTG	22	38.7 N	157.1 E	18	02	M 45	.5 NM	03	0997.0	4.0	11.5	10	8	27	10	8
SHUNWIND	ELTQ	22	54.3 N	174.9 W	18	06	M 42	10 NM	02	0977.0	1.5	5.0	4	8	07	7	19.5
TROPICANA	A8VM	23	20.0 N	172.4 E	00	27	M 44	5 NM	60	1002.0	19.0						
MARIA TOPIC	SMPS	23	31.2 N	159.5 E	00	29	50	5 NM	02	1011.0	16.5	18.0	9	11.5	27	12	13

Vessel	Nationality	Date	Position of Ship Lat. deg.	Long. deg.	Time GMT	Wind Dir.	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C Air	Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir.	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		JAN.															
SARGODHA	OUIU	23	44.9 N	169.7 W	00	24	N 44	2 NM	02	0998.8	7.2	4.0	3	16.5			
PERENNIAL ACE	HOMQ	23	54.2 N	171.8 W	03	08	N 42	1 NM	70	0971.5	3.0	3.5	5	8	09	7	11.5
VIENNA WOODS	SLOT	23	38.0 N	171.2 E	05	27	N 45	5 NM	80	0978.0	9.8	12.5	10	14.5	27	12	19.5
SHUNWIND	ELIQ	23	54.0 N	179.2 W	06	05	N 42	5 NM	26	0975.3	1.5	3.0	4	10	07	7	23
CHUEN ON	H3BX	23	33.8 N	177.3 E	12	27	N 45	2 NM	01	0994.5	12.5	17.0					
AMERICAN LARK	WZJF	24	34.8 N	163.0 E	00	31	N 45	10 NM	02	1013.5	12.7	13.4	5	8	XX		
SARGODHA	OUIU	24	46.8 N	159.0 W	06	22	N 46	2 NM	50	0971.5	6.0	6.0	6	19.5			
GREAT LAND	WFDP	25	58.7 N	150.2 W	00	11	N 44	1 NM	53	0989.8	6.7	7.7	5	10	12	6	13
SURVEYOR	WTCS	25	57.6 N	147.3 W	00	10	N 42	1 NM	42	0991.5	6.4	5.6	5	5	13	8	10
AMERICA SUN	WNEJ	25	58.9 N	141.9 W	00	13	N 48	2 NM	07	1004.3	7.0	5.6	5	14.5	15	6	16.5
KOREAN PRIDE	ELXF	25	54.9 N	144.6 W	00	14	N 48	.5 NM	58	0990.0	6.5	4.0	9	14.5	14	9	14.5
MARIA TOPIC	5HPS	25	34.6 N	150.3 E	06	32	60	1 NM	63	1010.5	15.0	18.0	9	13	27	11	18
CHUEN ON	H3BX	25	34.5 N	165.2 E	18	24	N 43	2 NM	02	0999.0	14.0	14.0	5		27	8	16.5
SEVEN OCEAN	JKBN	25	48.1 N	158.6 E	18	22	N 48	50 YD	10	0978.4	- 5.5	0.1	6		28	9	18
BELLMAN	9VUP	26	46.2 N	150.8 E	00	33	N 50	2 NM	74	1000.5	- 4.5	1.0	4	10	23	11	26
CRESSIDA	3FTB	26	46.2 N	155.3 E	06	29	N 50	.25 NM	94	0985.0	- 2.0	7.1	8	24.5	29	8	24.5
SEVEN OCEAN	JKBN	26	45.3 N	154.7 E	06	29	N 48	1 NM	66	0994.7	- 5.0	0.0	9	21	29	10	21
PERENNIAL ACE	HOMQ	26	47.5 N	153.4 E	15	29	N 53	1 NM	72	0993.5	- 2.5	1.5					
SKAUGRAN	LMUK	26	47.9 N	154.7 E	18	30	47	.5 NM	77	0992.5	- 3.7		15	19.5			
PRESIDENT GRANT	WEZO	26	47.5 N	153.9 E	18	31	N 56	.5 NM	73	0996.5	- 3.9	- 8.6	10	3	10	< 6	10
SHUNWIND	ELIQ	26	46.8 N	158.4 E	18	29	N 60	.5 NM	07	0985.0	- 2.0	2.0	8	19.5	29	7	32.5
SOUTH EXPRESS	A8WR	26	52.1 N	138.6 W	18	30	N 45	2 NM	50	0995.0	5.0	7.0	6	32.5	30	< 6	24.5
ORIENTAL MERCHANT	VRCS	26	47.0 N	156.8 E	21	29	N 46	1 NM	73	0987.0	- 3.0	0.0	4	29.5	29	8	46
SOUTH EXPRESS	A8WR	27	52.4 N	140.2 W	00	31	N 45	5 NM	80	0999.0	5.0	6.0	10	49	31	>13	32.5
SHUNWIND	ELIQ	27	46.8 N	155.8 E	00	29	N 52	.25 NM	75	0989.0	- 2.0	2.0	8	23	29	7	46
PRESIDENT GRANT	WEZO	27	43.9 N	149.3 E	12	30	N 48	1 NM	02	0990.5	- 5.1	0.6	8	6.5	07	6	10
SKOUBORD	LIQN	27	37.0 N	130.5 W	12	23	47	10 NM	01	1004.0	12.0						
WESTWARD VENTURE	KHJB	27	51.8 N	131.9 W	12	16	N 42	5 NM	03	0998.0	4.5	7.0	3	5	32	< 6	13
SKAUGRAN	LMUK	27	44.7 N	148.9 E	18	27	46	1 NM	73	1002.0	- 6.0		8	13			
CHUEN ON	H3BX	27	36.1 N	155.1 E	18	27	N 60	2 NM	18	1002.0	6.0	16.0	4		27		
MAUI	WSLN	27	36.3 N	127.5 W	18	22	N 45	10 NM	15	0999.5	14.9	19.4	6	14.5	XX		
MAUI	WSLN	28	37.0 N	125.0 W	00	22	N 45	5 NM	26	0992.0	12.8	15.0	4	5	26	7	16.5
SHUNWIND	ELIQ	28	44.3 N	152.9 E	00	29	N 50	1 NM	72	0983.8	- 2.0	2.0	6	19.5	29	8	24.5
OSNP	OSNP	28	49.6 N	151.0 W	00	26	N 47	5 NM	02	0997.0	5.0	9.0	8	13	28	9	13
SKOUBORD	LIQN	28	36.4 N	127.5 W	00	25	48	10 NM	80	1005.0	15.0						
PRESIDENT GRANT	WEZO	28	39.1 N	144.1 E	06	32	N 45	10 NM	02	1011.3	- 1.1	3.3	2	6.5	27	9	10
PACEMAKER	ELUU	28	43.2 N	155.2 E	12	29	N 44	5 NM	03	0999.5	5.1	2.0					
EASTERN TREASURE	6ZSP	28	45.5 N	165.2 W	12	20	N 45	2 NM	53	0986.5	7.0	9.0	7	18	19	12	23
UNITED SPIRIT	SMKM	28	36.7 N	175.5 W	18	35	N 47	2 NM	60	0983.5	9.0	13.0	8	13	04	8	13
HAKUSAN MARU	JFZG	28	39.1 N	135.8 W	18	29	N 41	5 NM	21	1014.3	11.0	12.5	5	5	29	8	14.5
SOUTH EXPRESS	A8WR	29	53.9 N	156.8 W	00	16	N 48	1 NM	10	0985.0	4.0	4.0	8	49	17	12	32.5
HAKUSAN MARU	JFZG	29	37.9 N	131.0 W	06	31	N 41	10 NM	01	1014.5	11.0	12.5		5	30		14.5
PACIFIC ARROW	JGFM	29	38.0 N	158.7 W	12	24	N 46	1 NM	01	0996.5	12.0	11.9	6	10	22	9	14.5
CRYSTAL STAR	DSTQ	29	48.9 N	151.2 W	18	13	N 43	.5 NM	02	0985.0	9.0	6.0	6	11.5	14	10	16.5
CRESSIDA	3FTB	29	36.6 N	147.1 E	18	27	N 42	2 NM	27	1010.0	9.0	10.8	7	16.5	27	7	16.5
ORIENTAL MERCHANT	VRCS	30	34.0 N	138.7 E	00	30	N 41	10 NM	01	1017.0	6.5	16.0	2	3	29	9	16.5
ARCO ANCHORAGE	WCIQ	30	58.7 N	144.2 W	12	11	N 50	2 NM	07	1005.0	3.9	3.9					
SEALAND INNOVATOR	WGKF	30	53.1 N	146.7 W	12	16	N 45	5 NM	02	0992.0	8.0	9.0	11	13	19	6	14.5
WESTWARD VENTURE	KHJB	30	57.6 N	146.4 W	12	13	N 44	.25 NM	65	0999.7	4.7	6.1	12	16.5	12	11	13
MOBILE MERIDIAN	KGSM	30	58.5 N	149.2 W	18	13	30	2 NM	10	0994.9	6.6	9.0	5	16.5	14	7	32.5
PACIFIC ARROW	JGFM	31	37.8 N	143.5 W	00	18	N 43	.25 NM	65	1005.0	15.0	13.1	5	10	17	8	13
NEPTUNE AMBER	5KCY	31	43.9 N	152.1 E	12	29	N 41	5 NM	70	1006.5	- 4.2						
PRESIDENT MC KINLEY	WVFZ	31	45.3 N	153.5 E	12	27	45	10 NM	02	0999.8	- 1.1	- 1.1	2	8	27	< 6	24.5
EASTERN TREASURE	6ZSP	31	48.0 N	141.1 W	18	17	N 33	2 NM	51	0993.0	11.0	5.0	7	19.5	15	12	32.5
TOYOTA MARU 12	JBJO	31	49.3 N	138.6 W	18	15	N 49	200 YD	51	1003.5	9.0	8.0	5	10	14	10	16.5
Environmental Buoys																	
46003		25	52.0N	150.0W	01	28	N 43			978.1	2.5	4.7	4	13			
46006		08	51.0N	136.0W	13	11	N 42			988.4	8.4	7.6					
46004		09	51.0N	136.0W	07	21	N 41			982.6	8.1	7.6					
46004		18	51.0N	136.0W	06	11	N 43			980.5	8.7	7.3					
46004		20	51.0N	136.0W	20	11	N 45			976.9	9.4	7.2					
46004		27	51.0N	136.0W	04	28	N 43			993.1	4.7	7.0					
46005		22	46.0N	131.0W	00	11	N 45			986.5	9.0	10.6	5	16			
		FEB.															
ARCO ANCHORAGE	WCIQ	1	52.6 N	139.3 W	00	13	N 52	2 NM	07	1000.5	7.8	3.9	6	10	15	13	24
SEALAND INNOVATOR	WGKF	1	53.8 N	173.4 W	12	31	P 45	.5 NM	75	0991.0	2.0	4.0	5	6.5	34	8	11.5
ALASKA STANDARD	WMDN	1	59.4 N	143.2 W	12	10	55	2 NM	61	1007.5	4.5	7.2	5	8	14	7	28
ARCO ALASKA	KSMA	1	57.1 N	140.4 W	12	13	N 50	2 NM	02	1004.0	6.1	5.5	4	16.5	13	>13	22
MAYA PIONEER	JLAX	1	53.2 N	173.7 W	18	33	N 45	.5 NM	26	0987.7	3.0	4.0					
ALEUTIAN DEVELOPER	WIPL	1	59.0 N	150.2 W	18	14	55	2 NM	16	0993.5	6.1	4.4	6	10	11	8	19.5
SIMBA	OWEC	1	38.0 N	149.2 E	18	07	N 50	2 NM	69	0995.2	6.0	10.5					
FORTUNSTAR	5LUW	1	35.4 N	148.1 E	18	27	N 45	.5 NM	01	0987.0	14.0	18.0					
PRINCE WILLIAM SOUND	WSDX	2	59.0 N	144.0 W	00	13	N 37	10 NM	15	1013.2	6.1	8.3	3	6.5	14	10	32.5
SIMBA	OWEC	2	38.5 N	150.8 E	00	07	N 50	2 NM	84	0996.0	4.8	10.5	5	13			
SILVERLIME	H3PF	2	36.1 N	150.0 E	00	05	55	1 NM	21	0980.0	19.0	14.0					
IKAN KERISI	9VKG	2	47.2 N	177.0 E	05	29	N 45	2 NM	07	0983.0	5.0	9.0	8	11.5	05	11	19.5
SANSINENA II	WSIN	2	56.2 N	143.9 W	06	20	45	1 NM	01	1007.8	5.6	4.4	6	14.5	20		
FORTUNSTAR	5LUW	2	35.2 N	151.3 E	06	34	N 62	.25 NM	05	0985.5	9.8	18.0					
GLACIER BAY	KACF	2	59.2 N	144.7 W	12	13	50	5 NM	02	1014.6	6.1	4.4	6	16.5	14	7	24.5
BARBER TAIF	LIBD	3	36.0 N	179.2 E	00	18	55	2 NM	63	0988.0	14.0	12.0	5	19.5			
SAMUEL S	5LHX	3	47.2 N	172.3 E	00	05	N 45	5 NM	03	0993.0	4.0	3.0	7	11.5	05	7	11.5
PIONEER NO 3	JQEF	3	41.7 N	179.2 W	06	09	42	2 NM	62	0973.2	4.5	10.0	6	14.5	09	8	16.5
FRIENDSHIP	ELXP	3	37.9 N	173.0 E	06	34	N 44	5 NM	02	0979.0	7.5	15.0	7	10	36	9	19.5
PRESIDENT HOOVER	WTSY	3	42.0 N	171.4 W	12	15	45	5 NM	25	0982.7	8.5	10.0	4	8	XX		
AMERICAN TRADER	WEZH	3	13.3 N	98.4 W	12	02	45	10 NM	02	1012.6	22.2	26.7	7	21			
PACEMAKER	ELUU	3	51.3 N	159.8 W	12	07	N 41	5 NM	00	0997.0	4.0	2.0					
ALVA MAERSK	OZSD	3	42.3 N	166.4 W	18	14	52	5 NM	61	0988.0	10.4	9.0	8	14.5	15	9	18
VILLANGER	5LGI	3	18.4 N	94.8 W	18	36	50	5 NM	02	1016.0	30.0	22.0	7	14.5	36	10	16.5
ZIM HONGKONG	4XLR	3	46.5 N	174.7 W	18	09	49	1 NM	62	0987.0	7.0		6	8	11	6	13
CHARLES LYKES	WLHR	3	38.0 N	174.5 W	18	27	45	5 NM	01	0992.5	12.2	11.1	5	13	21	10	16.5
IKAN KERISI	9VKG	3	49.1 N	171.9 W	21	11	N 50	2 NM	21	0983.0	4.5	7.0	10	32.5	09	10	36
EASTERN WORLD	ELVA	3	49.6 N	172.5 W	23	09	N 50	.5 NM	26	0996.2	3.0	0.3	6	23	09	9	49
IKAN KERISI	9VKG	4	49.3 N	171.5 W	00	10	N 60	1 NM	86	0975.0	4.0	7.0	7	24.5	09	11	24.5
ZIM HONGKONG	4XLR	4	47.5 N	173.5 W	00	07	47	5 NM	12	0983.0	7.0		8	10	12	7	13
SAMUEL S	5LHX	4	46.5 N	177.8 E	00	36	N 55	5 NM	02	0981.0	- 2.0	4.0	7	13	36	7	8
PRESIDENT HOOVER	WTSY	4	42.2 N	166.9 W	00	18	43	2 NM	16	0977.7	10.0	9.5	4	10	18	7	19.5
ALVA MAERSK	OZSD	4	42.5 N	161.8 W	06	15	55	1 NM	63	0990.0	11.7	9.7	9	14.5	15	11	21
SEALAND EXCHANGE	WFOU	4	49.9 N	177.1 W	06	05	45	.25 NM	23	0986.1	1.6	2.8	5	8	06	10	19.5
FRIENDSHIP	ELXP	4	36.3 N	178.7 W	06	30	N 43	5 NM	02	0999.0	8.0	14.0	8	19.5	30	9	21
PERENNIAL ACE	HOMQ	4	36.1 N	158.8 E	09	18	N 44	2 NM	07	1004.0	12.5	13.5	6	8	20		
PACIFIC VENTURE	HOVS	4	35.0 N	149.3 E	12	27	N 42	5 NM	02	1004.0	10.0	10.0	6	11.5	27	11	23

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*		Swell Waves	
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		FEB.															
QUEENS WAY BRIDGE	JHJE	4	38.7 N	174.8 W	12	18	M 50	5 NM	02	0999.5	5.5	13.0					
SEALAND ENDURANCE	KGJX	4	53.9 N	178.0 E	12	04	M 50	5 NM	02	0990.1	2.8	2.8			05	8	16.5
ARTHUR MAERSK	OXRS	4	52.8 N	176.3 W	12	05	55	2 NM	26	0977.0	3.0						
PRESIDENT TYLER	WEZM	4	53.5 N	160.8 W	18	11	M 78	2 NM	50	1009.5	4.4	3.3	6	13	14	8	32.5
HOMSING BREEZE	3EOU	4	53.6 N	178.0 W	18	05	M 50	1 NM	70	0975.3	3.0	3.0	9	16.5	05	9	16.5
SANKOSTEEL	SLSN	4	36.7 N	154.5 E	18	24	M 54	2 NM	13	0993.0	9.4	15.0	6	10	25	9	16.5
PRESIDENT KENNEDY	KCAK	4	54.3 N	169.3 W	18	08	45	5 NM	62	0997.8	4.5	3.9	3	6.5	12	6	5
EASTERN WORLD	ELVA	4	50.4 N	169.0 W	23	13	M 37	5 NM	80	0996.7	5.0	0.3	7	16.5	15	8	32.5
SANKOSTEEL	SLSN	5	36.9 N	156.4 E	00	28	M 56	2 NM	46	0994.0	9.0	15.0	10	13	29	9	16.5
ZIM HONGKONG	4XLR	5	45.8 N	167.3 W	00	25	45	2 NM	21	0998.2	9.0		7	16.5	22	9	13
SAMUEL S	SLHX	5	44.8 N	174.9 E	00	27	M 70	2 NM	68	0981.0	3.0	4.0	8	23	27	6	13
SURVEYOR	WTES	5	56.9 N	159.2 W	00	10	M 43	5 NM	02	0999.9	3.9	- 1.1	5	1.5	12	7	5
ARTHUR MAERSK	OXRS	5	53.2 N	175.5 E	00	05	42	1 NM	43	0980.0	2.5						
HOMSING BREEZE	3EOU	5	53.5 N	179.1 E	03	01	M 49	.5 NM	10	0968.9	2.3	3.0			03	10	14.5
IKAN KERISI	9VKB	5	50.2 N	165.4 W	05	19	M 42	2 NM	02	0983.0	6.0		7	32.5	19	10	32.5
SIMBA	OWEC	5	41.7 N	171.6 E	06	13	M 43	2 NM	62	0989.1	6.4	8.5	4	11.5	04	< 6	3
PACIFIC VENTURE	HOVS	5	34.4 N	155.2 E	06	32	M 42	10 NM	03	1006.1	13.0	16.0	8	11.5	32	11	23
PERENNIAL ACE	HOMQ	5	36.5 N	166.1 E	06	29	M 55	5 NM	07	0989.5	13.7	14.0	6	13	24	>13	16.5
PRESIDENT TYLER	WEZM	5	53.2 N	169.4 W	12	17	M 44	2 NM	02	0971.2	3.9	3.3	6	23	17	6	23
HONG KONG DELEGATE	6ZEW	5	31.7 N	175.8 E	18	22	M 42	1 NM	44	1006.0	17.0	17.0	5	14.5	18	9	16.5
SAMUEL S	SLHX	6	45.2 N	167.7 W	00	17	M 42	> 25 NM	01	1001.0	6.0	6.0	7	10	17	7	16.5
PERENNIAL ACE	HOMQ	6	37.0 N	171.7 E	00	31	M 46	5 NM	22	0999.5	12.0	14.0	7	11.5	28	< 6	16.5
WISTERIA	JJBD	6	54.2 N	169.2 W	00	13	M 42	5 NM	18	0986.0	6.0	5.0	8	11.5	13	10	13
BARBER TAIF	LIBD	6	35.6 N	151.2 W	06	30	42	5 NM	03	1005.0	10.0	13.0	4	19.5	30	7	19.5
FORTUNSTAR	SLUW	6	36.2 N	175.8 E	12	27	M 45	2 NM	02	1005.0	9.0	14.0	9	14.5			
SIMBA	OWEC	6	41.8 N	177.9 W	12	29	45	10 NM	27	0990.5	6.0	8.5	4	10			
SAMUEL S	SLHX	7	45.1 N	161.5 W	00	14	M 45	1 NM	61	0995.0	6.0	7.0	6	10	23	8	13
HOMSING BREEZE	3EOU	7	50.1 N	164.0 E	03	29	M 45	2 NM	07	0993.3	- 2.2	2.0	10	14.5	29	8	13
VERRAZANO BRIDGE	JBKJ	7	42.5 N	170.3 W	03	27	M 50	.5 NM	04	0991.5	7.0	8.0	9	16.5	26	9	16.5
PRESIDENT KENNEDY	KCAK	7	50.3 N	161.0 E	06	28	45	5 NM	03	1000.5	2.5	1.9	3	8	28	< 6	16.5
FORTUNSTAR	SLUW	7	36.2 N	179.4 E	06	29	M 46	10 NM	03	1013.5	10.0	14.0	12	5			
CRESSIDA	3FTB	7	34.8 N	144.2 E	12	01	M 44	2 NM	60	1004.0	10.0	20.2	5	13	01	< 6	14.5
BARBER TAIF	LIBD	7	35.3 N	140.5 W	12	10	48	5 NM	02	1007.5	17.0	14.0	5	24.5			
QUEENS WAY BRIDGE	JHJE	7	38.1 N	142.7 W	18	09	M 43	5 NM	50	1009.0	13.0	12.5	5	10	10	8	14.5
EVER VALUE	H3NH	8	33.4 N	149.3 E	00	31	M 20	10 NM	02	1008.1	12.0	20.0	7	8	31	< 6	32.5
BARBER TAIF	LIBD	8	34.9 N	136.8 W	00	09	55	2 NM	02	1006.0	15.5	16.0	10	29.5			
AMERICAN APOLLO	KEOD	8	35.1 N	160.9 E	00	18	45	2 NM	63	0994.5	15.0	16.7	5	13	18	6	13
AMERICAN CHALLENGER	WNEP	8	37.5 N	140.4 W	00	09	45	5 NM	81	1003.0	13.3	14.4	4	16.5	10	8	24.5
OGDEN CONGO	ABIP	8	37.2 N	154.8 E	00	32	M 50	5 NM	01	0986.0	8.0	13.0	8	11.5	18	< 6	5
PRESIDENT PIERCE	WUBV	8	44.4 N	162.2 E	06	08	45	.25 NM	86	0998.0	0.6	5.0	3	11.5	07	6	13
QUEENS WAY BRIDGE	JHJE	8	38.0 N	138.6 W	06	09	M 45	5 NM	02	1006.5	14.0		5	10	10	6	13
PRESIDENT TRUMAN	WLRL	8	39.2 N	162.9 E	12	29	45	10 NM	00	0983.7	6.7	9.9	10	16.5	25	9	19.5
CALIFORNIA RAINBOW	JNJL	8	51.0 N	170.3 E	18	10	M 44	5 NM	02	0995.0	1.0	4.0					
EVER VALUE	H3NH	9	33.4 N	158.2 E	00	28	M 18	10 NM	02	1012.2	15.0	18.0	5	16.5	28	< 6	32.5
SEALAND LIBERATOR	KHRP	9	52.7 N	170.8 E	00	11	M 48	5 NM	02	0996.7	3.0	2.0	13	13			
PRESIDENT TYLER	WEZM	9	45.4 N	149.8 E	00	31	M 50	10 NM	01	0999.5	- 3.9	0.0	12	13	31	< 6	10
ARILD MAERSK	OXTH	9	41.3 N	178.2 E	00	16	45	2 NM	63	0995.8	10.8	9.0	3	23			
ASIAN EXPRESS	ELOC	9	37.0 N	160.5 E	00	36	M 45	1 NM	03	1000.4	9.0	12.0	12	13	36	8	11.5
OJI GLORIA	5LTW	9	51.0 N	177.1 E	06	12	M 46	2 NM	02	0993.0	1.0	3.5	8	16.5	13	10	19.5
PRESIDENT PIERCE	WUBV	9	46.5 N	172.1 E	12	21	30	10 NM	01	0987.0	2.2	2.8	5	11.5	21	7	36
AUSTRAL RAINBOW	WEZP	9	32.0 N	157.5 W	12	29	45	2 NM	82	0993.2	10.0	15.0	6	13	29	8	24.5
SUGAR ISLANDER	KCKB	9	29.5 N	141.0 W	12	24	40	.5 NM	21	1001.0	17.8				24	11	41
CALIFORNIA RAINBOW	JNJL	9	50.2 N	163.2 E	18	27	M 57	2 NM	02	0972.0	0.0	3.0					
BLUE OCEAN	JKOH	9	52.8 N	171.5 E	18	14	M 42	2 NM	02	0998.5	3.4	2.0	5	10	14	7	14.5
EVER VALUE	H3NH	10	33.5 N	168.0 E	00	14	M 22	5 NM	02	1005.4	12.5	17.0	3	8	21	6	41
EVER SHINE	HPET	10	32.9 N	165.6 E	00	22	M 42	2 NM	50	0999.5	17.5	16.0	5	10	24	6	14.5
SUGAR ISLANDER	KCKB	10	28.7 N	142.5 W	00	23	35	10 NM	01	1005.1	17.3		5	5	23	8	32.5
SEALAND LIBERATOR	KHRP	10	49.5 N	162.5 E	00	26	M 42	5 NM	07	0982.7	- 1.0	1.0	14	23			
HONG KONG DELEGATE	6ZEW	10	31.8 N	152.8 W	00	24	M 42	5 NM	03	0993.0	16.0	15.0	7	16.5	25	8	19.5
AUSTRAL RAINBOW	WEZP	10	34.3 N	152.4 W	06	29	45	5 NM	15	0988.0	15.3	13.3	4	16.5	27	7	23
PRESIDENT TRUMAN	WLRL	10	39.6 N	178.0 E	12	16	45	2 NM	02	0987.5	10.6	13.4	16	26	18	>13	26
SIMBA	OWEC	10	44.3 N	148.3 W	12	10	M 42	2 NM	62	0994.1	10.1	8.0	7	14.5			
SAMUEL S	SLHX	11	43.7 N	147.0 W	00	13	M 45	2 NM	02	0999.0	11.0	9.0	4	8	10	9	13
SUGAR ISLANDER	KCKB	11	26.6 N	146.3 W	00	24	15	10 NM	02	1011.2	18.9		3	5	27	8	32.5
EVER SHINE	HPET	11	31.4 N	159.6 E	00	26	M 42	5 NM	01	1000.5	17.0	16.0	5	8	26	< 6	14.5
DAWN	WLDP	11	22.6 N	171.0 W	18		57	> 25 NM	02	1008.6	20.5	23.8	3	5	31	< 6	6.5
SEATRAIN CHESAPEAKE	OSOC	11	38.0 N	158.1 E	23	27	M 70	5 NM	02	0980.0	6.0	11.0	35	57.5	27		23
SEATRAIN CHESAPEAKE	OSOC	12	38.0 N	157.9 E	05	32	M 50	5 NM	62	0984.0	8.5	8.0	10	19.5	26		21
BARBER TOBA	LHOE	12	33.7 N	162.9 E	06	29	M 45	2 NM	81	0994.0	10.0	17.0	8	19.5			
NOPAL BRANCO	LAHW	12	37.6 N	150.4 E	06	31	M 43	10 NM	03	1009.1	7.5	11.0	5	13	29	11	19.5
SANTA MAGDALENA	KAAH	12	11.5 N	97.0 W	12	04	40	5 NM	03	1011.5	25.0	27.8	8	24.5	04	10	57
PERENNIAL ACE	HOMQ	12	35.1 N	138.7 W	15	19	M 45	2 NM	63	0998.0	17.0	16.0					
ARILD MAERSK	OXTH	12	37.4 N	138.1 W	18	15	45	2 NM	63	0996.5	16.8	13.0	3	23			
SEALAND EXPLORER	WGJF	12	34.1 N	161.1 E	23	33	M 45	10 NM	15	1003.6	11.0	14.0	5	26	32	< 6	29.5
SAMUEL S	SLHX	13	41.5 N	134.4 W	00	16	M 64	1 NM	63	0995.0	14.0	15.0	4	10	14	9	13
BARBER TOBA	LHOE	13	33.1 N	171.1 E	06	28	M 48	2 NM	81	0989.0	11.0	17.5	10	26			
KEYSTONER	KISR	13	16.1 N	94.4 W	12	36	46	10 NM	02	1015.9	19.4	16.7	2	6.5	36	13	10
NEW JERSEY MARU	JHYA	13	27.4 N	149.3 E	12	32	M 43	5 NM	02	1006.0	15.0	20.0	5	8	30	10	19.5
TYSON LYKES	WSCJ	13	26.8 N	175.9 E	18	28	38	10 NM	07	1001.0	17.5	17.8	3	16.5	30	>13	41
SEALAND EXPLORER	WGJF	13	33.2 N	169.1 E	18	31	M 47	10 NM	01	0998.5	10.0	15.0					
SARGODHA	OUIU	13	49.5 N	135.8 W	18	23	M 60	.5 NM	02	0997.2	8.8	12.0	4	16.5			
SEALAND EXPLORER	WGJF	14	33.5 N	171.5 E	00	29	M 47	5 NM	01	0999.5	14.0	16.0	5	32.5	29	< 6	32.5
BARBER TOBA	LHOE	14	33.0 N	176.9 E	00	28	M 45	5 NM	81	0991.0	12.0	17.5	10	23			
SKOUBORO	LION	14	51.8 N	133.6 W	00	18	47	5 NM	02	0996.0	9.0						
NOPAL BRANCO	LAHW	14	39.7 N	167.2 E	06	31	M 48	5 NM	03	1004.0	5.2	10.7	6	16.5	24	>13	29.5
CHUEN ON	H3GX	14	48.6 N	167.7 W	06	07	M 45	5 NM	02	0986.5	3.0	5.0	5	8	07	10	23
PRESIDENT MADISON	WCIP	14	24.1 N	177.7 E	06	28	45	10 NM	02	1005.0	20.0	20.5	4	11.5	28	8	14.5
SEALAND MCLEAN	WHBA	14	49.8 N	132.6 W	12	24	45	5 NM	02	0994.7	7.2	6.1	9	16.5	20	>13	16.5
ALEUTIAN DEVELOPER	WIPL	14	51.6 N	134.0 W	12	25	55	5 NM	02	0985.0	8.9	6.7	6	14.5	21	9	29.5
SANSINENA II	WSIN	14	50.0 N	133.6 W	12	24	45	2 NM	07	0993.6	7.8	7.2	5	19.5	22	10	26
MOBILE MERIDIAN	KGSM	15	56.9 N	140.0 W	18	28	25	10 NM	03	0988.2	3.8	5.0	4	13	18	7	32.5
TALISMAN	LFEN	16	37.2 N	166.3 E	06	31	41	10 NM	26	1009.3	7.5	12.0					
QUEENS WAY BRIDGE	JHJE	16	47.2 N	136.3 W	06	22	M 41	2 NM	51	0986.5	11.0		3	6.5	23	6	11.5
CORNUCOPIA	KPJC	16	46.2 N	130.1 W	18	25	45	2 NM	62	0993.6	8.8	9.5	8	13	25	10	13

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		FEB.																
THOMPSON PASS	WSPY	16	45.5 N	130.5 W	18	24	N 50	2 NM	02	0992.5	10.0	11.7	6	16.5	24			
ORIENTAL MERCHANT	VRCS	17	45.1 N	148.9 W	09	24	N 48	2 NM	61	0985.0	8.0	5.0						
CHUEN ON	H35X	17	49.1 N	135.8 W	12	20	N 45	5 NM	03	0996.0	8.0	8.0	5	11.5	23	8	24	
SEATRAIN INDEPENDENCE	DSKL	17	49.3 N	150.0 W	22	27	45	5 NM	61	0987.0	5.0	5.0	6	11.5	22	12	19.5	
SHUNWIND	ELTQ	18	35.6 N	155.0 E	03	29	N 55	10 NM	07	1002.0	10.0	10.0	6	13	29	6	29.5	
WESER EXPRESS	DLDE	18	34.5 N	155.1 E	06	31	60	2 NM	01	1010.1	10.1	16.0	12	23	31		29.5	
SURVEYOR	WTES	18	55.2 N	161.7 W	06	01	N 46	10 NM	01	0982.5	- 7.2	2.2	4	5	04	7	11.5	
MARIA TOPIC	SMPS	18	41.1 N	172.4 E	18	26	60	1 NM	60	0991.0	10.0	13.0	10	13	00		C	
SEATRAIN INDEPENDENCE	DSKL	18	51.9 N	159.6 W	19	28	45	2 NM	26	0998.8	0.0	3.0	7	11.5	25	10	16.5	
ASIA INDUSTRY	A8SI	19	40.2 N	176.7 E	00	25	N 50	2 NM	03	0970.5	11.2	13.0	17	19.5	25	>13	21	
MARIA TOPIC	SMPS	19	41.1 N	174.0 E	00	27	60	1 NM	02	0994.6	13.6	13.0	8	11.5	27	>13	19.5	
MADANG	ELTJ	19	48.3 N	178.2 W	03	09	50	2 NM	72	0987.5	0.0	0.0		16.5	07	10	6.5	
TALISMAN	LFEN	19	41.1 N	167.8 W	06	16	45	2 NM	55	0990.0	12.5							
PERENNIAL ACE	HQWQ	19	50.0 N	136.7 W	12	30	N 52	5 NM	01	0989.0	6.5	8.0	6	16.5	30	9	16.5	
TOYOTA MARU 12	JBJG	19	37.1 N	163.8 W	12	29	N 43	2 NM	02	1010.0	13.0	13.0	6	10	23	9	13	
UNIVERSAL WING	8KXF	19	34.8 N	177.8 W	12	28	N 46	5 NM	02	1008.8	12.5	15.0	5	10	29	8	26	
PRESIDENT MC KINLEY	WWF2	19	36.0 N	148.1 E	12	23	45	5 NM	02	1005.0	15.6	15.0	3	10	23	8	26	
ORIENTAL MERCHANT	VRCS	19	48.1 N	129.4 W	12	26	N 52	5 NM	03	0988.0	8.0	7.0						
ARCO CALIFORNIA	WNCV	19	49.2 N	133.5 W	12	28	N 50	2 NM	01	0997.7	7.2	8.9	4	11.5	29	< 6	18	
EXXON SAN FRANCISCO	KAAC	19	47.4 N	131.2 W	16	27	50	5 NM	16	0999.6	10.1	7.3	4	41				
PACIFIC VENTURE	HOVS	19	50.1 N	129.5 W	18	27	N 58	1 NM	44	0986.0	8.0	10.0	8	26	26	10	32.5	
KEYSTONE CANYON	KSFK	19	49.8 N	133.8 W	18	29	45	10 NM	02	0996.5	5.6	7.2	7	23	29	8	23	
SIENA	GXFU	19	47.3 N	153.7 W	18	19	N 45	2 NM	63	0989.0	9.0	12.0	8	24.5				
AMERICA SUN	WNEJ	19	49.9 N	134.1 W	18	24	N 41	5 NM	01	0999.0	6.0	6.7	4	6.5	24	8	13	
CRESSIDA	3FTB	19	48.5 N	129.5 W	18	27	N 46	.5 NM	05	1000.0	6.0	10.3	10	14.5	27		16.5	
POLAR ALASKA	5LEU	20	46.1 N	155.8 E	00	08	N 50	200 YD	73	0990.0	0.0	0.0	5	13				
PRINCE WILLIAM SOUND	WSDX	20	52.0 N	132.1 W	00	26	N 45	5 NM	60	1022.0	7.8	8.9	3	11.5	XX		23	
SIENA	GXFU	20	47.4 N	151.8 W	00	23	N 45	2 NM	68	0993.0	9.2	12.0						
PRESIDENT GRANT	WEZO	20	43.4 N	149.5 W	00	20	N 44	10 NM	53	1017.2	10.6	8.7	1	5	XX	< 6	10	
PACSTAR	6ZFW	20	47.1 N	162.0 W	00	21	N 42	1 NM	07	0978.0	6.0	6.0	6	8	21	7	13	
ASIA INDUSTRY	A8SI	20	48.0 N	177.2 W	00	32	N 42	10 NM	01	1006.8	8.0	11.0	12	16.5	32	>13	19.5	
CRYSTAL STAR	D5TG	20	44.2 N	151.8 E	00	32	N 42	200 YD	64	0982.0	1.0	8.5	12	16.5	32	12	19.5	
TALISMAN	LFEN	20	43.4 N	161.6 W	00	22	55	2 NM	02	0989.5	11.1							
PRESIDENT KENNEDY	KCAK	20	51.0 N	162.5 W	00	03	43	5 NM	75	0976.0	- 2.2	3.3	3	11.5	04	6	13	
PACIFIC VENTURE	HOVS	20	50.6 N	130.5 W	00	29	N 37	2 NM	07	1005.2	9.0	10.0	7	29.5	29	8	26.5	
EXXON SAN FRANCISCO	KAAC	20	47.8 N	131.5 W	00	29	45	10 NM	03	1016.9	10.0	7.2	7	41				
NEPTUNE AMBER	S6CY	20	38.9 N	157.6 E	06	28	N 47	10 NM	01	1004.2	8.0	11.6	6	6	27	9	13	
EASTERN TREASURE	6ZSP	20	46.3 N	156.2 E	12	36	N 40	.25 NM	86	0994.0	0.0	1.0	8	24	36	>13	36	
SEALAND DEVELOPER	WRRH	21	41.7 N	169.9 E	00	26	N 45	10 NM	02	1004.0	9.0	10.0	3	10	25	9	19.5	
SEATRAIN INDEPENDENCE	DSKL	21	51.2 N	178.0 E	04	08	45	.25 NM	76	0998.0	0.0	2.0	6	16.5	08	12	23	
KOREAN LEADER	D7KX	22	36.7 N	159.9 E	00	30	41	5 NM	02	0997.0	12.0	13.0	9	14.5	30	9	16.5	
MILLER FREEMAN	WTDM	22	56.3 N	168.9 W	00	06	N 54	.5 NM	45	0991.5	- 1.5	3.1		6.5	06	8	32.5	
EXXON SAN FRANCISCO	KAAC	22	55.5 N	140.1 W	00	28	45	10 NM	03	1006.8	3.3	3.9	5	24.5				
PACIFIC VENTURE	HOVS	22	54.5 N	147.1 W	00	28	N 34	5 NM	07	1011.2	4.0	6.0	7	29.5	26	8	34.5	
BELLMAN	9VUP	22	35.8 N	164.5 E	06	28	N 50	5 NM	02	0998.5	13.0	16.5	4	5	28	10	23	
GARDENIA	A8UA	22	36.8 N	159.9 E	06	28	N 52	5 NM	02	1001.0	7.5	13.0	9	11.5	27	>13	19.5	
PERENNIAL ACE	HQWQ	22	54.1 N	160.8 W	21	33	N 41	5 NM	03	1007.0	2.5	4.0	6	8	30	8	16.5	
KOREAN PRIDE	ELKF	23	37.2 N	149.0 E	00	25	N 52	10 NM	01	0996.7	8.0	16.0	4	5	25	< 6	6.5	
SEALAND PATRIOT	KHRF	23	52.0 N	169.2 E	00	31	N 45	.5 NM	78	0993.5	4.0	2.0	5	16.5	07	12	16.5	
SEALAND ENDURANCE	KBJX	23	39.3 N	154.5 E	00	31	N 50	10 NM	03	1014.5	4.4	11.0	30	13	31	8	16	
GARDENIA	A8UA	23	36.8 N	165.6 E	00	27	N 58	2 NM	20	1003.0	6.0	15.0	9	13	27	>13	28	
BELLMAN	9VUP	23	36.1 N	170.1 E	00	27	N 60	5 NM	60	1003.0	10.0	16.0			27	12	32.5	
MILLER FREEMAN	WTDM	23	54.2 N	166.9 W	18	12	N 45	10 NM	02	1003.6	2.6	3.8		3	12	6	10	
OVERSEAS JUNEAU	WWND	23	14.0 N	95.5 W	18	02	45	5 NM	01	1010.0	24.5	21.6	6	19.5	02	>13	19.5	
OVERSEAS JUNEAU	WWND	24	14.0 N	96.6 W	00	07	45	5 NM	02	1007.6	25.0	24.4	4	16.5	04	>13	19.5	
BELLMAN	9VUP	24	35.9 N	176.9 E	00	28	N 50	5 NM	25	1008.5	10.0	14.0	5	3	26	11	32.5	
SEALAND PATRIOT	KHRF	24	47.5 N	159.0 E	00	31	N 48	.5 NM	27	0999.0	- 2.0	0.0	6	32.5	XX			
KOREAN PRIDE	ELKF	24	38.0 N	175.9 E	00	28	N 44	5 NM	01	1005.1	11.0	12.0	4	10	28	8	10	
PACIFIC VENTURE	HOVS	24	54.4 N	165.5 W	00	11	N 31	.5 NM	45	0999.5	4.0	3.0	6	29.5	13	8	34.5	
SOUTH EXPRESS	A8WR	24	38.0 N	168.3 E	18	27	N 45	5 NM	61	1002.0	8.0	11.0	3	13	27	< 6	10	
JAPAN CADDO	9MKV	25	33.3 N	158.4 E	00	22	45	5 NM	03	1004.0	18.0	17.0	6	10	22	12	14.5	
PRESIDENT TAFT	WLDT	25	54.0 N	154.8 W	00	24	45	5 NM	02	0990.4	5.5	4.4	7	24.5	14	8	24.5	
SARGODHA	GUIU	25	31.0 N	126.1 E	06	32	N 52	5 NM	00	1025.5	6.8	13.0	8	16.5				
ENNA S	C2DS	25	32.0 N	170.0 W	06	30	09	10 NM	01	1028.0	14.0	15.5	3	5	30	>13	34.5	
POLAR ALASKA	5LEU	25	41.4 N	148.2 E	12	35	N 52	1 NM	73	0986.0	- 1.0	5.0	5	13	00		C	
YOUNG SCOPE	6ZLH	26	48.0 N	158.0 E	00	25	N 50	10 NM	02	0994.5	8.5	10.0	8	13	25	10	23	
AMERICAN LEGION	WZJC	27	34.2 N	163.5 E	06	27	41	10 NM	16	0999.0	16.1	15.0	8	13	24	12	19.5	
PACIFIC VENTURE	HOVS	27	47.9 N	158.1 E	06	35	N 31	10 NM	03	0994.6	2.0	1.0	6	29.5	01	8	34.5	
BALTIMORE TRADER	KASJ	27	12.9 N	93.2 W	16	36	10	2 NM	05	1011.0	24.4	24.0	10	34.5	10	12	1.5	
SURVEYOR	WTES	27	58.4 N	172.8 W	18	07	N 48	5 NM	02	0975.2	- 4.0	0.6	2	3	07	< 6	6.5	
PRESIDENT TYLER	WEZM	28	35.0 N	159.5 E	00	28	N 49	10 NM	61	1014.0	11.1	13.3	12	16.5	28	9	32.5	
PACIFIC VENTURE	HOVS	28	41.0 N	146.0 E	18	30	N 32	5 NM	02	1019.3	- 1.0	1.0	6	29.5	31	8	34.5	
KOFUKU MARU	JKLB	28	53.3 N	176.0 E	18	30	N 55	< 50 YD	84	0969.0	0.0	3.0	8	13	30	8	16.5	
Environmental Buoys																		
46003		25	52.0N	156.0W	00	24	M 41											
46004		19	51.0N	136.0W	12	30	M 44											
46005		16	46.0N	131.0W	21					985.4	5.0	6.0						
										999.7	10.7	9.8		20				

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

U.S. Cooperative Ship Weather Reports

January and February 1981

SHIP NAME	VIA RADIO	VIA MAIL
ACE ENTERPRISE	8	24
ADRIAN MAERSK	12	58
AGUADILLA	48	95
ALBATROSS IV	14	
ALISA	3	
ALVA MAERSK	29	68
AMERICAN ACCORD	17	60
AMERICAN AQUARIUS	22	
AMERICAN ASTRONAUT	35	103
AMERICAN CORSAIR	47	140
AMERICAN LANCER	16	97
AMERICAN LEGEND	24	84
AMERICAN RACER	3	12
AMERICANA	2	
ANDALUSIA	7	
ANTE TOPIC	43	
ARCO CALIFORNIA	44	48
ARCO PRUDHOE BAY	4	
ARIES		8
ASHLEY LYKES	18	
ASIA FLAMINGO	23	
ASIAN ASSURANCE	2	
ATLANTIC RAINBOW	27	149
AUSTRAL MOON	56	141
AXEL MAERSK	25	
BALD BUTTE	18	121
BARBER TOBA	24	47
BASSWOOD WLB308	4	1
BELLMAN	44	57
BLUE OCEAN	19	104
BOSTON	24	61
BRINTON LYKES	38	41
BUTTONWOOD WLB 306	51	
CANADIAN REEFER	26	
CARIBBEAN ENDEAVOUR	1	
CHARLES PIGOTT	4	165
CHASE WMEC 718	1	
CHEMICAL VENTURE	53	
CHESNUT HILL	27	
CHEVRON CALIFORNIA	61	87
CHEVRON KENTUCKY	60	
CHEVRON OREGON	19	54
CHEVRON WASHINGTON	43	98
CHRISTIAN MAERSK	1	26
CK APOLLO	10	
COLORADO	12	23
COLUMBUS VICTORIA	66	119
CONDATA	2	32
CRESSIDA	39	128
D ALBERTS	12	46
DART EUROPE	93	100
DEFIANCE	20	57
DEL RIO		25
DELAWARE SUN	11	32
DIAMOND PHOENIX	29	143
DJATINEGARA	12	
DON JUAN	38	51
DRUCILLA U	35	47
EASTERN DIAMOND	4	183
EASTERN RIVER	2	
EASTERN WORLD	27	17
ENNA G	72	143
ESSO PALM BEACH	8	
EVER SPRING	24	
EXPORT BUYER	17	51
EXPORT FREEDOM	17	69
EXXON BOSTON	8	18
EXXON NEW ORLEANS	23	27
FALSTRIA	27	94
FREDERICK LYKES	25	88
GAGE LUND	76	
GARDENIA	34	41
GEORGE L PARKHURST	1	
GLADIOLUS	12	
GOLDEN BEAR	35	110
GOLDEN GATE BRIDGE	62	39
GOLDEN ROD	8	
GREAT LAND	56	82
GREEN FOREVER	91	110
GREEN VALLEY	6	
GULF MERCHANT	2	
HAMILTON WMEC 715		10
HARUNA MARU	116	83
HELLYER BROWN	4	4
HOEGH MASCOT	6	14
HOEGH OPAL	9	
HONSING BREEZE	40	59
INGER	2	105
IRONWOOD WLB 297	46	
J LOUIS	21	93
JAMES LYKES	9	32
JAPAN CADBO	17	93
JOHN HENRY	1	
JUTLANDIA	1	
KENAI	27	40
KOREAN COMMANDER	5	12
KUROBE MARU	60	35
LAKE PALOURDE	26	137
LASH ITALIA	3	
LESLIE LYKES	43	84
LONE STAR	1	
LUIGI GRIMALDI	31	
MALLORY LYKES	3	24
MANISTEE	6	
MANUKI	44	107
MARCONA EXPORTER	27	177
MARIA TOPIC	20	126
MARITIME HARMONY	9	
MARJORIE LYKES	6	
MAUI	91	138
MAYAGUEZ	23	94
MELVILLE	20	153
MERCY	12	
MING GALAXY	16	21
MING STAR	14	34
MOBIL LUBE	22	47
MOBILGAS	12	49
NORMACALTAIR	11	64
NORMACOLEN	3	15
NORMACSAGA	10	
NORMACVEGA	3	
NAGARA	20	
NEPTUNE CRYSTAL	3	
NEW GOLDEN PHOENIX	54	
ACONCAGUA	7	12
ADRIATIK	91	
AIMEE LYKES	2	29
ALBERT MAERSK	17	40
ALLISON LYKES	4	
AMELIA TOPIC	11	61
AMERICAN ACE	24	93
AMERICAN ARCHER	29	81
AMERICAN CHALLENGER	35	97
AMERICAN EXPLORER	9	
AMERICAN LARK	20	92
AMERICAN LEGION	5	120
AMERICAN RANGER	2	27
AMUR CAREER	51	129
ANDERS MAERSK	19	40
ANTONIA JOHNSON	15	118
ARCO FAIRBANKS	69	121
ARCO SAG RIVER		36
ARILD MAERSK	13	65
ASIA BEAUTY	12	
ASIA HERON	8	
ASIAN EXPRESS	42	139
AUSTRAL ENTENTE		50
AUSTRAL PIONEER	29	87
AZTECA	1	
BALTIMORE TRADER	17	109
BARBERGATE	1	
BAYAMON	7	26
BERKSHIRE	29	
BLUEBIRD	54	
BOUTWELL WMEC 719	55	
BROOKS RANGE	14	27
CALIFORNIA RAINBOW	42	84
CAPRICORN	34	55
CARNIVALE	13	40
CHARLESTON	20	118
CHASTINE MAERSK	13	24
CHEROKEE WMEC 165		84
CHEVRON ANTWERP		14
CHEVRON COLORADO	45	103
CHEVRON LONDON		168
CHEVRON PERNIS	23	224
CHIBA	39	48
CHRISTOPHER LYKES	8	
CLARA MAERSK	13	
COLUMBUS AMERICA	27	101
COMMON VENTURE	18	
CORAL ACE	2	
CRISTOBAL	3	72
DAFFODIL	11	48
DAVID D. IRWIN	25	30
DEL CAMPO	7	79
DEL VIENTO	3	5
DELTA BRASIL	1	
DIANA	43	
DOCEANGRA	2	
DONA CORAZON II		34
DUBHE	7	
EASTERN FORTUNE	2	28
EASTERN SUN	4	24
EDWARD RUTLEDGE	8	
ESSO ALBANY	2	
ESSO SAINT JOHN	35	60
EVER VALUE	14	49
EXPORT CHALLENGER	12	62
EXPORT PATRIOT	14	57
EXXON FLORENCE	1	4
EXXON PHILADELPHIA	23	57
FEDTRADE	9	
FRIENDSHIP	14	80
GALLEON AQUAMARINE		62
GARTNERGYDD	3	
GEORGE M KELLER	9	103
GLOBAL FRONTIER	52	104
GOLDEN DAISY	11	3
GOLDEN ORCHID	6	
GRACE	1	
GREAT OCEAN	36	38
GREEN HARBOUR	11	67
GUADALUPE I	2	28
GULF TRADER	4	
HANJIN INCHEON	12	16
HAWAIIAN CITIZEN	10	5
HOEGH CLIPPER	6	45
HOEGH MERCHANT	3	28
HOEGH ORCHID	22	10
HOWARD G VESPER	3	39
INGHAM WMEC 35		52
ITALY MARU	23	16
JACKSONVILLE	17	65
JAPAN ACE	44	58
JAPAN RAINBOW	12	31
JOHN LYKES	16	63
KASHU MARU	62	51
KENNETH E HILL	25	90
KOREAN PIN	19	17
L.W. FUNKHOUSER		57
LAKE SHASTA	11	
LASH PACIFICO	39	23
LETITIA LYKES	8	
LOUISE	34	98
LYNCH Y-AGOR 7	1	30
MAMMOTH FIR	21	
MANUANILI	55	94
MANZANARES	10	
MARCONA TRADER	8	37
MARIAS TAO-57		3
MARITIME INVESTOR	17	
MASON LYKES	36	171
MAUMEE	51	149
MAYO LYKES		6
MENESTHEUS	23	
MEXICO	3	
MING GLORY	34	
MINNETONKA WMEC 67	3	
MOBIL POWER	34	104
MONROUTH	8	28
NORMACARGO	4	1
NORMACLYNX	13	33
NORMACSTAR	4	33
NORMACWAVE	11	57
NANCY LYKES	10	
NEPTUNE DIAMOND	37	115
NEW JERSEY MARU	79	123
ADABELLE LYKES	10	
AFRICAN DAWN	25	82
ALASKA STANDARD	17	21
ALEUTIAN DEVELOPER	47	47
ALLTRANS EXPRESS	18	50
AMERICA MARU	93	52
AMERICAN ALLIANCE	27	105
AMERICAN ARGOSY	35	107
AMERICAN CRUSADER	1	107
AMERICAN HERITAGE	8	64
AMERICAN LEADER	31	101
AMERICAN LIBERTY	29	108
AMERICAN RELIANCE	15	
ANCO STANE	81	
ANNA MAERSK	20	39
ARCO ALASKA	52	66
ARCO JUNEAU	51	54
ARECIBO	19	16
ARNOLD MAERSK	16	66
ASIA BOTAN	5	
ASIA INDUSTRY	12	29
ATHEL LAAOKI	8	
AUSTRAL ENVOY	9	
AUSTRAL PUNTIAN	44	98
B T ALASKA	13	119
BARBER PRIAM	38	
BARRANCA	81	67
BAYANO	40	
BIBB WMEC 31		3
BOHEME	8	48
BRAZOS	78	70
BUILDER	8	35
CALIFORNIAN	17	
CAPTAIN COOK	1	
CHANCELLORSVILLE		60
CHARLOTTE LYKES	5	73
CHAUVENET T AGS 29		157
CHERRY VALLEY	1	58
CHEVRON ARIZONA	62	109
CHEVRON COPENHAGEN	36	
CHEVRON MISSISSIPPI	40	90
CHEVRON PERTH	2	134
CHIKO	6	18
CHUEN ON	17	116
CLIFFORD MAERSK	9	24
COLUMBUS LOUISIANA	27	
CONCORDIA STAR	21	39
CORNUCOPIA	22	95
CRYSTAL REED	5	
DALAMAR	17	
DAVID P REYNOLDS	44	165
DEL MONTE	2	29
DELAWARE SETTY	19	104
DELTA CARIBE	5	53
DILIGENCE WMEC 616	9	
DOCTOR LYKES	19	74
DONA MAGDALENA		29
DYVI KATTEGAT	5	62
EASTERN MUSE	52	
EASTERN TREASURE	48	50
EL MERICANO	2	
ESSO BANGKOK	28	
EURO-ASIA CONCORDE	31	
EVERGREEN WAGO-295	89	91
EXPORT CHAMPION	5	
EXXON BALTIMORE	18	49
EXXON HOUSTON	16	32
EXXON PHILADELPHIA	24	55
FORTUNSTAR	26	48
FRISKY	1	41
GALLEON ONYX	4	18
GENEVIEVE LYKES	18	
GLACIER WAGB 4	167	146
GLOBAL WING	13	
GOLDEN DOLPHIN	2	
GOLDEN PRINCE		6
GRAND FELICITY	17	28
GREAT REPUBLIC	8	47
GREEN ISLAND	14	
GULF BANKER		24
H J HAYNES		77
HANJIN POHANG		5
HELLESPONT GLORY	4	35
HOEGH ELITE	1	
HOEGH MERIT	6	
HOEGH PRIDE		1
HOWELL LYKES	43	
IRIS ISLAND	17	67
ITAPUCA	2	
JALAYAMUNA	5	
JAPAN AMBROSE	45	28
JEAN LYKES	6	
JOSEPH LYKES	19	
KAUAI	175	134
KEYSTONER	67	71
KOREAN LEADER	4	18
LAKE ARROWHEAD	5	
LAKE TANGO	43	145
LAVAUX	23	39
LEXA MAERSK	41	
LOUISE LYKES	4	53
MADALENA	88	
MANHATTAN	40	88
MANUKAI	59	103
MARCHEN MAERSK	21	39
MARCONA TRANSPORTER	18	91
MARINE CHEMICAL TRANSP	23	87
MARITIME JUSTICE	18	
MATHIESON		16
MAYA		16
MAYON	5	
MENINA ALICE	21	
MIDAS SEINE	18	
MING MOON	45	27
MOBIL AERO	11	104
MOBILE MERIDIAN	34	70
MONTERREY	6	
NORMACDAWN	13	61
NORMACMOON	13	47
NORMACSUN	21	69
MOUNT VERNON VICTORY	13	38
NECMES	28	14
NEPTUNE JADE	34	
NEW JERSEY SUN	5	8
ADM WM M CALLAGHAN	10	107
AFRICAN STARS	4	50
ALASKAN	21	94
ALGENIB	29	58
ALMERIA LYKES	28	91
AMERICA SUN	26	126
AMERICAN APOLLO	92	145
AMERICAN ARROW	4	
AMERICAN CHIEFTAIN	18	39
AMERICAN HIGHWAY	16	
AMERICAN LEGACY	48	123
AMERICAN LYNX	25	104
AMERICAN TRADER	32	104
ANCO MEMPLAR	51	
ANNIE JOHNSON	13	69
ARCO ANCHORAGE	88	97
ARCO PRESTIGE	2	9
ARGONAUT	16	19
ARTHUR MAERSK	10	34
ASIA BRAVERY	9	
ASIA MORALITY	2	
ATLANTIC PIONEER	13	
AUSTRAL LIGHTNING	44	88
AUSTRAL RAINBOW	80	109
B T SAN DIEGO	1	87
BARBER TAIF	23	41
BARNA	7	40
BEISHU MARU	94	44
BLESS RIVER	6	54
BORINQUEN	8	62
BRILLIANT STAR	15	11
BUNGA MELAWIS	2	
CAMPBELL WMEC 32	18	
CARIBBEAN CARRIER	1	
CHARLES LYKES	43	136
CHARLOTTE MAERSK	6	12
CHAVEZ	2	
CHESHIRE	29	63
CHEVRON BURNABY	5	80
CHEVRON FELUY	2	
CHEVRON NORTH AMERICA		27
CHEVRON SOUTH AMERICA		92
CHIKUMA	1	
CITRUS WLB300	27	
CLOVER	32	93
COLUMBUS NEW ZEALAND	22	68
CONCORDIA SUN	4	
COURAGEOUS WMEC 622	25	32
CRYSTAL STAR	49	109
DANA AMERICA	1	
DAVID STARR JORDAN	11	35
DEL ORO	1	20
DELAWARE II	29	31
DELTA SUD	3	50
DITTE SKOU	11	31
DOLLY TURMAN	24	
DORIC	11	76
E. HORNSBY WASSON		158
EASTERN PACIFIC	24	33
EASTERN WISEMAN	11	
EL PASO HOWARD BOYD	1	
ESSO BAYONNE	12	
EVER SHINE	31	97
EXPORT BANNER	5	
EXPORT COMMERCE		28
EXXON BANGOR	2	4
EXXON HUNTINGTON	12	36
EXXON SAN FRANCISCO	31	50
FRANCIS SINCERE NO 6.	40	
FRONTIER	1	
GALLEON OPAL	1	
GEORGE B KELEZ	40	14
GLACIER BAY	19	148
GLOMAR CHALLENGER	61	103
GOLDEN GATE	5	39
GOLDEN RAY	9	
GRAND GLOBE	19	14
GREEN AUKLET	35	
GREEN KOBE	11	28
GULF FARMER	20	10
HAKUSAN MARU	122	65
HARDANGER	3	29
HIKEI MARU	119	84
HOEGH MALLARD	5	
HOEGH MIRANDA	7	
HOEGH TRIGGER	10	32
INACHUS STAR	25	121
IRIS QUEEN	47	
IVAN TOPIC	10	39
JALAYAMUNA	4	
JAPAN APOLLO	44	52
JELA TOPIC	17	48
JUTHLANDIA	3	95
KEIYO	17	47
KOFUKU MARU	34	80
KOREAN PRIDE	18	10
LAKE MENDOCINO	6	
LASH ATLANTICO	14	69
LEO	21	11
LILLOOET	51	38
LUCENT STAR	1	
MAHARSHI KARVE	10	
MANICA	4	29
MANULANI	78	149
MARCONA CONVEYOR	3	13
MARDI GRAS	3	24
MARITIME DOMINION	19	23
MARITIME RELIANCE		3
MATSONIA	46	97
MAYA PIONEER		88
MEADOWBROOK	1	71
MEONIA	41	114
MILLER FREEMAN	64	77
MING SPRING	1	
MOBIL ARCTIC	49	173
MOBILFUEL	10	38
MORANT	37	
NORMACDRACO	5	46
NORMACRIBEL	9	48
NORMACTIDE	7	64
MT MITCHELL	29	76
NEPTUNE AMBER	51	135
NEPTUNE RUBY	11	
NEW YORK MARU	26	67

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS JANUARY AND FEBRUARY 1981

SHIP NAME	VIA RADIO	VIA MAIL	SHIP NAME	VIA RADIO	VIA MAIL	SHIP NAME	VIA RADIO	VIA MAIL	SHIP NAME	VIA RADIO	VIA MAIL
NEWARK	104	131	NORDAWAY	49	79	NOPAL BRANCO	12	58	NOPAL LANE	14	
NORDIC LOUISIANA	43		NORSE PILOT	33	20	NORTHERN LIGHT	1	1	NORTHERN VICTORY	41	138
NORWAY	29		OCEAN CROWN	16		OCEAN LOG		1	OCEANIC	49	168
OCEANOGRAPHER	99	90	OCTA	1	11	OGDEN CHALLENGER	1		OGDEN CHAGO	27	71
OGDEN FRASER	23	49	OGDEN WILLAMETTE	3	80	OJI GLORIA	47	60	OLEANDER	107	124
OLGA MAERSK	6	30	ORANGE	46		ORCO MINER	7		ORE JUPITER	15	
ORE MEDITERAN	12	184	ORIENTAL CHAMPION	29	43	ORIENTAL COMMANDER	22	48	ORIENTAL ESEARCHER	10	10
ORIENTAL EXECUTIVE	7	39	ORIENTAL EXPORTER	19		ORIENTAL IMPORTER	7	16	ORIENTAL LEADER	12	48
ORIENTAL MERCHANT	78	117	ORIENTAL SOVEREIGN	31	36	ORIENTAL STATESMAN	36	88	ORIENTAL TAIO		106
ORUNDA	1		OTTO N. MILLER	16	106	OVERSEAS ALEUTIAN	4		OVERSEAS ARCTIC	11	68
OVERSEAS JOYCE	16	70	OVERSEAS JUNEAU	25	105	OVERSEAS MARILYN	3	36	OVERSEAS NEW YORK	6	
OVERSEAS VALDEZ		2	PACBARON	12	19	PACBARONESS	18	11	PACDUCHESS	8	18
PACDUKE	21		PACEMPEROR	17		PACGLORY	22	44	PACIFIC ACE	25	73
PACIFIC ARROW	103	61	PACIFIC ERA	54	35	PACIFIC HIGHWAY	75	68	PACIFIC PEACE		58
PACIFIC SAGA	43	19	PACIFIC TRADER	39		PACIFIC VENTURE	67	174	PACLADY	20	
PACMAJESTY	5		PACMERCHANT	6	12	PACMONARCH	10		PACNOBLE	8	9
PACPRINCE	17		PACPRINCESS	15		PACSTAR	38	49	PAN ANTILLES	1	
PAN ASIA	7		PAN WESTERN	17	12	PARALLA	33	51	PASSUMPSIC 48-197		48
PAYSANDU	1		PEINCE	26		PENNMAR	9		PERENNIAL ACE	102	128
PERRYVILLE	7	28	PHILADELPHIA	44	60	PHILIPPINE ANTONIO LUN	4	16	PINK SKY	7	
PIONEER CONTENDER	24	39	PIONEER MOON	36	60	POINT MARSO	12		POLAR ALASKA		73
POLAR SEA	133		POLAR STAR WASB-10	65		POLYNESIA	63	161	PORTLAND	94	73
POTOMAC	9	21	PRESIDENT ADAMS	6	52	PRESIDENT CLEVELAND	42	60	PRESIDENT FILLMORE	31	59
PRESIDENT GARCIA	12	52	PRESIDENT GRANT	54	124	PRESIDENT HARRISON	1		PRESIDENT HOOVER	67	128
PRESIDENT JACKSON	16	34	PRESIDENT JEFFERSON	17	75	PRESIDENT JOHNSON	48	75	PRESIDENT KENNEDY	33	107
PRESIDENT MADISON	32	62	PRESIDENT MC KINLEY	31	86	PRESIDENT PIERCE	39	97	PRESIDENT TAFT	21	98
PRESIDENT TAYLOR	39	33	PRESIDENT TRUMAN	43	39	PRESIDENT TYLER	60	123	PRESIDENT VAN BUREN	23	67
PRESIDENT WILSON	25		PRINCE OF TOKYO	35	39	PRINCE WILLIAM SOUND	41	126	PROSPERITY	6	
PROSPERITY QUEEN	9	82	PROVINCIA DE EL ORO	4	19	PUNTA BRAVA	9	35	PUNTA MALVINAS	2	
PURE OIL	10	91	QUEENS WAY BRIDGE	97	90	QUINTINA	34		RALPH B JOHNSON	31	112
RED JACKET	10		REGINA CELI	1		RELIANCE WMEC 615		12	RESEARCHER	65	100
RESOLUTE	9		REVERE	10	109	RICHARD	25	57	RIO ABAUCAN	25	23
RIO CHONE	1		RODRIGUES CABRILHO	16		ROSE		176	ROSE CITY	13	22
ROYAL VIKING SEA	22		ROYAL VIKING SKY	41	34	ROYAL VIKING STAR	32		RUTH LYKES	32	103
SACRAMENTO	3		SALVADOR	6	46	SAM HOUSTON	8		SAMBA	69	120
SAMUEL S	17	30	SAN BLAS		94	SAN FRANCISCO	25	64	SAN JUAN	15	65
SAN MARCOS	11	13	SANKOTRAIN	28	23	SANKOSTAR	9		SANKOSTEEL	14	56
SANKOSUN	6		SANSINENA II	32	106	SANTA ADELA	1	71	SANTA BARBARA	1	
SANTA CLARA	4	26	SANTA CRUZ	2	26	SANTA ELENA	19	98	SANTA FE	22	68
SANTA JUANA	3	47	SANTA LUCIA	1	12	SANTA MAGDALENA	20	52	SANTA MARIA	9	28
SANTA MARIANA	9	70	SANTA MERCEDES	19	81	SANTA PAULA	5		SARGODHA	43	105
SATSUMA	15	54	SCANDINAVIAN HIGHWAY	10	7	SEA FAN	6	11	SEA LAND VOYAGER	45	88
SEA TRANSPORT	16		SEALAND COMMERCE	34	13	SEALAND CONSUMER	23		SEALAND DEFENDER	32	29
SEALAND DEVELOPER	59	118	SEALAND ECONOMY	36	76	SEALAND ENDURANCE	60	107	SEALAND EXCHANGE	57	130
SEALAND EXPRESS	19	55	SEALAND FINANCE	51	99	SEALAND FREEDOM	38	69	SEALAND GALLOWAY	54	146
SEALAND INDEPENDENCE	33	102	SEALAND INNOVATOR	56	78	SEALAND LEADER	21	107	SEALAND MARKET	7	48
SEALAND MCLEAN	67	131	SEALAND PATRIOT	57	106	SEALAND PRODUCER	14	103	SEALAND RESOURCE	54	119
SEALAND VENTURE	6	128	SEATRAIN INDEPENDENCE	54	83	SEATRAIN ORISKANY	24	67	SEATRAIN YORKTOWN	20	99
SEATTLE	3	20	SEAWAY	14		SEDGE WLB 402	7		SEKI ROKAKO	2	18
SELANDIA	19	53	SEPTA	24	93	SEVEN OCEAN	15	6	SHANGRI LA	8	
SHIRLEY LYKES	8		SHUNWIND	49	126	SIENA	28	70	SILVER PAGODA	1	
SILVER PHOENIX	14	14	SILVERLIME		142	SILVERPLANA	14	89	SIMBA	52	84
SINALOA	3	19	SINCERE NO 7	7		SINCERE NO 9	13	19	SINCLAIR TEXAS	3	57
SKAUGRAN	61	118	SNOUBORD	39	103	SKYWARD	5	1	SNOW STORM	7	
SNOWDRIFT	21	89	SOCONY VACUUM	23	8	SOWIO INTREPID	54	151	SOLON TURMAN	17	32
SOUTHWARD	13	9	SOUTHWEST CAPE	7		SPERO	16		SPIRIT OF LIBERTY	1	
SPRAY DERRICK	15		STADT BREMEN	16		STAR DIEPPE	42		STAR DOVER	16	73
STAR HONGKONG	34		STARWARD	50	111	STATE OF MAINE	15		STELLA LYKES	17	
STOLT LLANDAFF	32	144	STONEWALL JACKSON	4	24	STORIS WASB 38	12		STREAM HAWSER	9	
SUGAR ISLANDER	40	91	SUNNY STATE	25	81	SURVEYOR	85	123	SUSQUEHANNA	40	41
SVENDORG MAERSK	25	102	SWEETBRIER WLB 405	38		T F L INDEPENDENCE	1		T F L LIBERTY		31
TAINO VENTURE	4		TAKARA	1		TALISMAN	22	39	TAMPA	17	34
TASSO	2		TERRIER	11		TEXACO MASSACHUSETTS	12	29	TEXACO MONTANA	1	
TEXACO RHODE ISLAND		31	TEXAS	15	86	TEXAS TRADER	8	76	TFL DEMOCRACY	17	69
TFL FREEDOM	10	66	TFL ITALY	14	69	THOMAS G THOMPSON	23	33	THOMAS NELSON	15	64
THOMAS WASHINGTON	11	136	THOMPSON LYKES	2		THOMPSON PASS	10	37	TILLIE LYKES	19	121
TOKYO RAINBOW	29	90	TOLUCA	1	17	TONCI TOPIC	2	81	TONSINA	24	91
TOWNSEND CROMWELL	119	138	TOYOTA MARU 10	113	36	TOYOTA MARU 12	105	102	TOYOTA MARU 83	60	72
TRANSCOLORADO	16	66	TRANSCOLUMBIA	14	46	TRAVIATA	4	15	TRIUMPH	29	105
TROPICANA	15	32	TSU	15	23	TUNISIAN REEFER	18		TYSON LYKES	56	117
ULTRASEA	2	40	UNIMAR WTD-379		31	UNIQUE FORTUNE	3		UNITED SPIRIT	31	75
UNIVERSE	11		UNIVERSE KURE	47	156	USNS ATAKAPA	21		USNS POWHATEN TATF 166		58
VALLEY FORGE	21	13	VAN CONQUEROR	40	42	VAN FORT	5		VAN HAWK	37	84
VAN TRIUMPH		40	VANGUARD		89	VELMA LYKES	38	9	VERRAZANO BRIDGE	26	64
VICENTE GUERRERO	1		VIENNA WOODS	18	7	VIGOROUS WMEC-627		32	VILLANDER	3	11
VIOLET	18		VISHVA SHANTI	3	18	WALCHAND	1		WALTER RICE	38	101
WASHINGTON TRADER	23	26	WASHINGTON WOOD	4	48	WEBER EXPRESS	92	139	WESTERN HIGHWAY	89	76
WESTERN SUN	5	27	WESTWARD VENTURE	53	88	WILLIAM E MUSSMAN	9	83	WILMINGTON BETTY	35	64
WINTER WATER	10	28	WINTER WAVE	25	57	WISTERIA	61	48	WOODRUSH WLB407	5	
WORLD CANDOUR	35	115	WORLD CHAMPION	1		WORLD CREST	1		WORLD HERCULES		17
WORLD MEDAL	6		WORLD RUBY	7		WTAM 1AG-534	1		YAMASHIN MARU	94	99
YOCONA WMEC 168	11		YOUNG SCOPE	14	41	YOUNG SEAGULL	9		YUKON T-AO 152	49	119
ZIM HONGKONG	15	48	ZIM MONTREAL	21	79	ZOELLA LYKES	11	44	ATPS	39	94
ATGL	26	48	ATUZ	6	8	ABIJ		44	ABLW	12	30
ARAA	46	90	BLMN	29	43	CBMD		40	DHCO	1	20
DSEL		2	DSBC	27	126	DSVL	8	10	DSXO	18	42
D6NZ		21	DTPY		5	D7BY	14	53	D9CB		23
ELADA	6	344	ELFY		83	ELIJ	7	11	ELOG	24	36
ELSU	20	41	ELTM	51	109	WPCF	9	34	WSLI	10	16
H3SY	1	81	H6AB	1	1	H8DZ		73	H8RD	10	57
H9HJ	9	25	H9IB	3	7	JCUF	2	14	JEUS	11	15
JIGL		9	JHGY	36	57	JMXI	37	21	JMZH	19	24
JPMD	24	11	JRES	17	29	KA8285	88	219	KGJF	46	104
KHRP	32	94	KIDH		5	KPKL	8	54	KSFJ	13	78
KSFK	26	58	KSLB	37	125	LIWN		32	LZJP		14
NDCY	58	96	NHMN		159	NHRN		463	0W8I	16	16
OWBT		14	OWYC		15	3BLW	2	49	SAGZ	38	78
WDBU		25	WDZB	35	118	WGJF	26	56	WWEL		59
WQZ4220		24	WYS3241		7	WZLR190		12	YCSA	37	129
YCSS	20	40	ZCKW	19	48	ZCUY	5	28	3EBN	14	26
3FYC	8	13	5LUB	31	136	5WUE	23	129	5MYH	1	6
6ZL8	10	31	6ZRT	35	104	8KXF	110	61	9KDR		32
9VKS	24	47	9VXU	9	160						

SUMMARY: GRAND TOTAL VIA RADIO 20065 GRAND TOTAL VIA MAIL 42855

Rough Log, North Atlantic Weather

April and May 1981

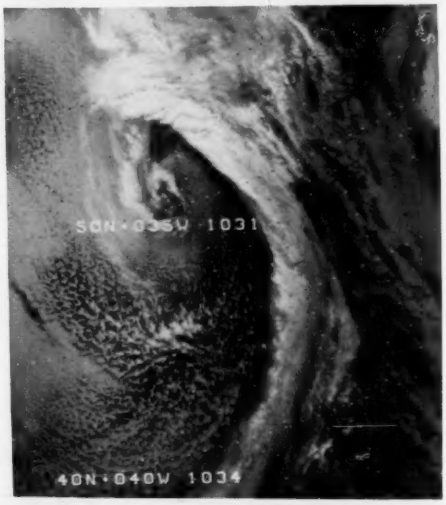
ROUGH LOG, APRIL 1981--The ocean south of latitude 40°N hosted only two significant low-pressure systems. No storm managed to survive a complete crossing. Several storms formed on the east side of a blocking HIGH off Europe and entered the continent. There were three short-lived storms over the Mediterranean. The primary storm track matched one of the climatological tracks from the Great Lakes to over the Canadian Maritime Provinces, where the track split into the Labrador Sea and to the Denmark Strait. This was the only track of any importance. A climatological track from off the U.S. East Coast did not exist.

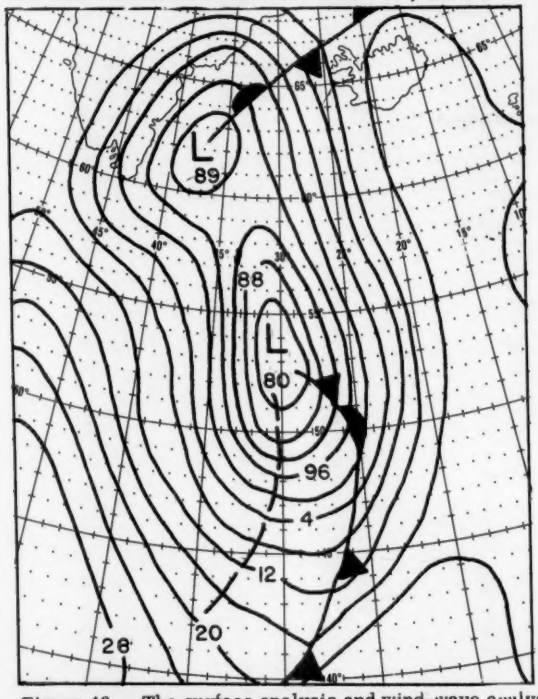
The mean sea-level pressure pattern was skewed counterclockwise. The 1008-mb Icelandic LOW was the Labrador Low at 50°N, 60°W. The Azores High at 1024 mb was shaped like a boomerang with a second 1024-mb center west of Ireland. Even though the Icelandic Low was 1,000 mi southwest of its climatic position, the pressure over the southeastern United States was 4 mb above normal.

The displacement of the pressure centers from the normal resulted in a large 13-mb positive anomaly center over the Rockall Bank and a minus 4-mb center near Corner Brook, Newfoundland. There was also a positive 4-mb area between latitudes 30° and 40°N and the Carolina coasts and longitude 45°W.

The upper air pattern over the eastern United States was near normal out of the west-northwest, but the trough along 60°W was sharper than usual. Also, there was a sharp ridge west of the European coast, which resulted in air flow slightly south of southwest toward Iceland from the central Atlantic. These surface and upper air ridges diverted the cyclones to the north away from Europe.

Extratropical Cyclones--The first storm this month moved across the Maritime Provinces on March 31. It was not until April 1 that it became significant. At 1200 it was off Cape Race. The KRTB and SEDCO





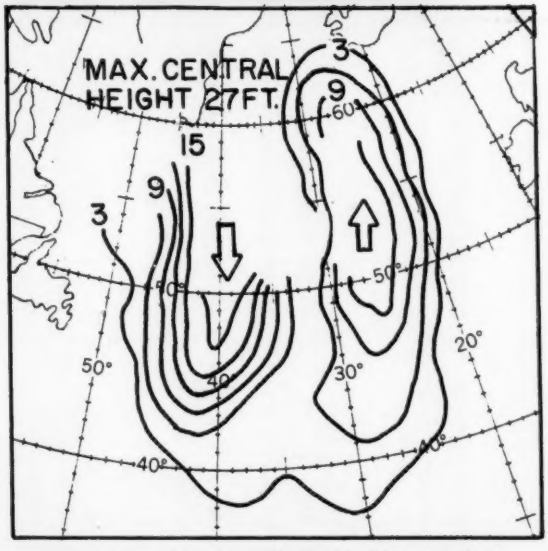


Figure 46.--The surface analysis and wind-wave analysis prepared from ship observations for 1200, April 2, 1981. Also, the satellite imagery for 1030.

east of Cape Race both had 50-kn winds. The OCEA nearby had 25-ft seas 6 hr later. The WILDENTE reported 60-kn winds with 26-ft waves at 2100. On the 2d the ATLANTIC CAUSEWAY and C.P. DISCOVERER in the vicinity of 50°N, 43°W, both had 33-ft swell waves. Their winds were 40 to 55 kn.

At 1200 on the 2d, the pressure was 980 mb near 53°N, 30°W. There were many wind reports over 40 kn and some as high as 55 kn with waves of 25 to 33 ft (fig. 46). On the 3d the storm was pushing against a HIGH over Scotland and weakening. There were still a few gales. Another center had formed on the front west of Portugal. The original storm was gone by the 4th.

A LOW that developed over the eastern slopes of the Rocky Mountains tracked across the Great Lakes but dissipated on the 6th as another center formed over the Gulf of St. Lawrence. At 1200 on the 7th the storm was 983 mb near Cartwright, Labrador (fig. 47). A ship with the call letters WFLH (38°N, 67°W) on the southwestern edge of the storm reported 53-kn winds. At 1800 there were reports of 40- and 45-kn winds over the Gulf of St. Lawrence. There were a few gale reports on the 8th behind the front. On the 9th at 1200 the storm was over Iceland and on the 10th was racing toward Spitsbergen. The KUNUNGUAK at 59°N, 38°W, had 44-kn winds with 26-ft seas. Later in the day another LOW formed in the elongated trough northeast of Kap Farvel.

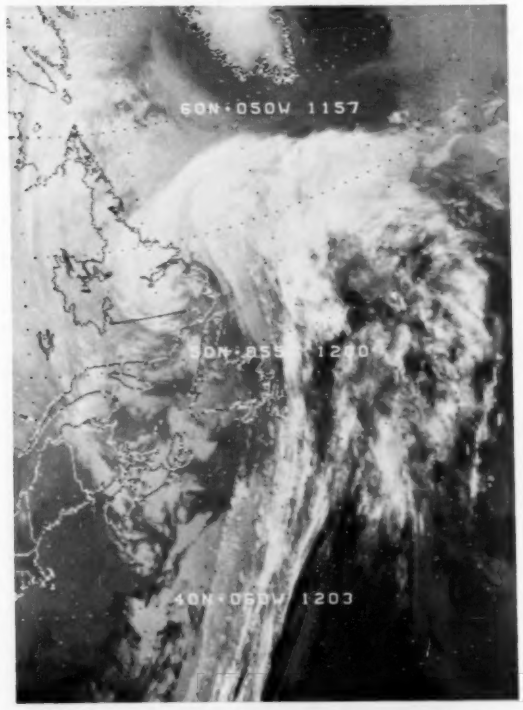


Figure 47.--The affect of the moisture and heat from the sea, even though cold by bathing standards, can be seen in this image.

A weak LOW was traveling eastward across southern Canada on the 11th. By the 12th this center had disappeared and another had appeared over the Gulf of St. Lawrence. At 1200 on the 12th the 996-mb storm was near Cape Race. The SEA-LAND LEADER (40°N, 54°W) had 40-kn winds, while the EDWARD CORNWALLIS (45°N, 61°W) found 45 kn. At 1800 the U.S. ship KHRK (44°N, 43°W) had 50 kn.

At 1200 on the 13th the storm was 990 mb south of Kap Farvel. Ocean Weather Station Charlie had 40-kn winds from the south just prior to passage of the occluded front. A Belgian ship near 50°N, 35°W, was also east of the front with 50-kn southerly winds and 30-ft waves. On the 14th this storm also came up against a stubborn HIGH north of Scotland, and in less than 24 hr it disappeared.

On the 14th an old weak front stretched southwestward between cells of the Bermuda and Azores Highs. Cyclonic circulation was found on the front on the 15th. As often happens with meteorological systems, they don't behave as they should. This frontal wave moved south along the front instead of north. On the 16th the LOW turned northerly again as the Azores High retreated northward. The first strong wind was recorded on the 17th by the LACKENBY with 47 kn and 20-ft swells near 47°N, 41°W. At this time another wave had formed on the front as the first one dissipated. On the 18th there were a few gale reports with seas as high as 20 ft. On the 19th (fig. 48) the FALSTRIA near 43°N, 28°W, had 40-kn winds and 26-ft swells. Another storm was moving into the area from the west and absorbed this one.

This storm originated over Alberta, Canada, and traveled eastward along the border. The first gales were found on the 18th off the East Coast. On the 19th (fig. 48) a Canadian ship near 49°N, 59°W, reported 61-kn winds. There were some wave reports of 20 ft. At 1200 on the 20th the 994-mb storm was near 42°N, 50°W. The CARCHESTER (49°N, 34°W) found 44-kn easterly winds. A ship to the south had 23-ft waves. On the 21st the storm was weakening.

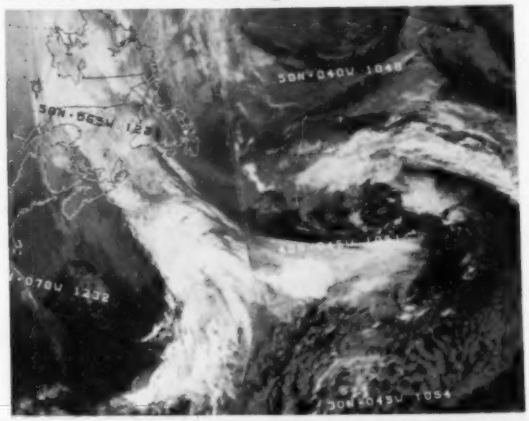


Figure 48.--This storm is elongated northwest-southeast and centered near 41°N, 39°W. Another storm described below can be seen to the west. It was centered near 39°N, 64°W.

This storm formed near Cape Cod. As it moved over the Gulf Stream, it deepened and produced gales off the East Coast on the 21st. A Canadian reporter that was stationary near 44°N, 59.5°W, had winds over 45 kn and waves up to 20 ft on the 22d. Also, the SEA-LAND GALLOWAY (42°N, 62°W) found 20-ft waves. At 0000 on the 23d the LOW was 984 mb over Cabot Strait (fig. 49). That Canadian reporter near 44°N, 59.5°W (CJR6), probably a drilling rig, now had winds greater than 50 kn. The GENERAL JASINSKI, sailing toward the northeast near 39°N, 64°W, was finding winds higher than 50 kn. The storm was over Newfoundland on the 24th and loosing its punch as another circulation to the southwest eroded that quadrant where the stronger winds tend to be found. The storm stalled near 50°N, 55°W, and was gone on the 25th.

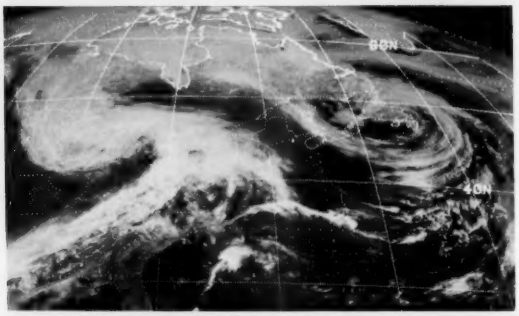


Figure 49.--At 1700 on the 23d the storm was over the south coast of Newfoundland. The next storm is pounding the Great Lakes.

Casualties--The STANISLAW DUBOIS and OMDURMAN collided in fog on the 2d off Rotterdam. The MONZA touched rocks in fog while entering Pasajes, Spain, on the 3d. On the 8th the PRINSES PAOLA contacted a mole entering Dover.

On the 11th the MED AMBITION anchored off Las Palmas for a survey and temporary repair of heavy-weather damage. The GREEK SKY returned to Malta because of heavy-weather damage to her air cooler. According to a bulletin dated on the 14th the AMIRA K. dragged anchor at Alexandria and contacted the PYRAMIDS U.

The POINT SUSAN was disabled with no power near 37°N, 36°W, on the 18th in heavy weather. The KILKENNY lost the starboard anchor and 26 ft of cable during heavy weather while approaching Rotterdam on the 19th.

The tourist vessel BERDICE (90 tons) capsized on the 22d, 400 mi south of Cairo, in a thunderstorm. Thirteen of the 83 passengers were missing. The Greek EVA suffered engine damage in heavy weather on the 23d enroute to Pasajes. The SAINT NAZAIRE from Dakar to Basse Indre reported heavy weather damage on the 26th. The 471-ton WEGRO (fig. 50) was swept aground on the 26th at Great Yarmouth by gales.

The CHOCANO grounded in heavy weather on the 27th at Leghorn. The BALDER CABOT lost a container overboard on the 30th near 61°N, 01°E, in 55- to 65-kn winds.

Other Casualties--Another "freak" wave off South Africa. The Liberian ENERGY ENDURANCE with 200,000 tons of oil aboard was hit by a large wave south of Durban. Bow plates were sprung and peeled back at the 60- to 65-ft level. An oil slick 100 mi

Figure 50.--The Dutch cargo vessel WEGRO was left high and dry on the beach at Great Yarmouth, England, by gales on the 26th. Wide World Photo.

long, 30 mi off the coast resulted from the spilling of 3,000 tons of bunker oil.

ROUGH LOG, MAY 1981--This was more like a summer than a spring month. The ocean was relatively quiet, except off the east coast of the United States and the vicinity of the British Isles. There was no primary storm track over the major shipping lanes, but there was one over the Great Lakes-St. Lawrence River system extending to Kap Farvel. Two storms moved across the East Coast, and several more formed some distance off the coast. One storm tracked from Quebec to the Baltic Sea and another formed northeast of Bermuda and made it to Ireland. There was a series of cyclones that circled over and west of the United Kingdom during the last half of the month. There was one storm that affected the northern Mediterranean the first week.

The mean sea-level pressure chart reflected cyclone tracks. What would have been the Icelandic Low was the 1004-mb Irish Low near Donegal Bay. There was also a small 1012-mb LOW center near Hoare Bay in Baffin Island and a 1013-mb depression over northern Vermont. The most prominent feature was the 1026-mb Azores High centered near 34°N, 42°W. It differed from climatology with a ridge extending northward along longitude 45°W to latitude 55°N.

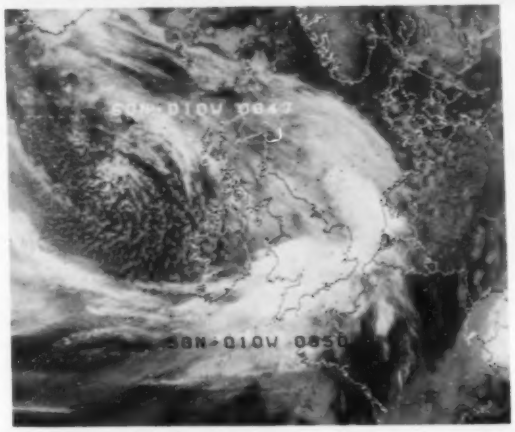
The deepest and largest anomaly was minus 11 mb near Fastnet Rock. The ridge extending toward Kap Farvel resulted in a plus 7-mb anomaly center about 500 mi east of Cape Race. There was a large flat area of up to minus 3 mb over the southeastern United States to 60°W, between 30° and 40°N.

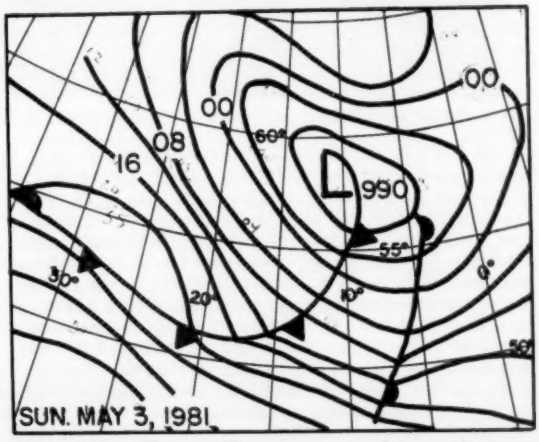
The upper air had an anomalous pronounced ridge over midocean along approximately 40°W. There were long-wave troughs along 65° and 10°W.

The tropical cyclone season got off to an early start this month with Arlene.

Extratropical Cyclones--This was the only storm this month that tracked from continent to continent. It moved off the Labrador coast early on the 1st. The E.E. PRINCE was in the Strait of Belle Isle at 1200 with 45-kn winds blowing up the Strait. The storm passed over Kap Farvel at 0000 on the 2d. Late that day the FRITHJOF was in the Denmark Strait with 44-kn northerly winds and 18-ft waves. By 1200 on the 3d the 990-mb storm was near 59°N, 11°W(fig. 51). Several ships off Ireland and in the southern North Sea had about 40 kn. The JACK WHARTON, south of Fastnet Rock, had 47 kn with 21-ft waves. Lima measured 35 kn with 20-ft seas. At midday on the 4th the storm was over the North Sea but causing no harm.

This LOW formed in the area of primary cyclogenesis off the U.S. East Coast, but it didn't go anywhere. It was first analyzed on the 1200 chart of the 3d. The CG26 (44°N, 64°W) found 45-kn north-northeasterly winds. At 1800 the NOVA GORICA (38°N, 59°W) had southeasterly 52-kn winds with 15-ft waves. The LOW was moving southwesterly--the opposite of the usual direction. At 0000 on the 4th buoy 41001 measured 23-ft seas. The ATLANTIC COGNAC (39°N, 71°W) reported 52-kn winds from 030° with 26-ft seas. At 1200 the LAERTES (38°N, 71°W) reported the winds as 45 kn from 020° with 20-ft seas and 26-ft swells. By 0000 on the 5th the storm was turning northward at 998 mb near 32°N, 66°W (fig. 52). The NORDIC LOUISIANA (30°N, 66°W) had 42-kn gales. The storm was only a weak trough on the 7th.





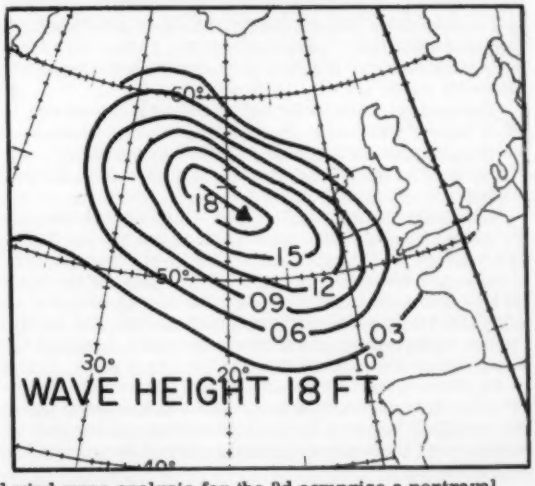


Figure 51.--The satellite image, surface analysis, and wind-wave analysis for the 3d comprise a portrayal of the storm.

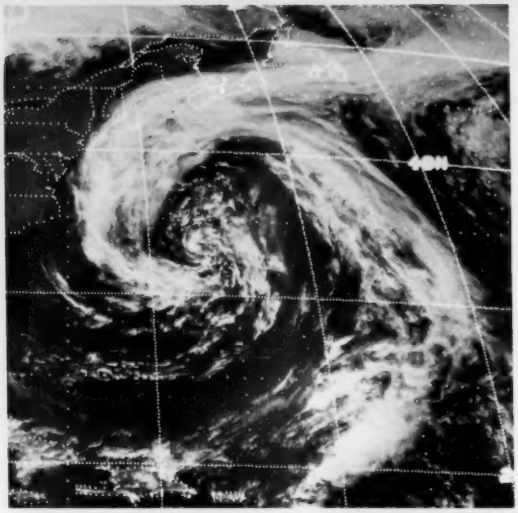


Figure 52.--At 1700 on the 4th the storm was still drifting southward.

Monster of the Month--This storm's claim to fame was mostly some high-wave reports. It formed in a sharp frontal trough west of the Bay of Biscay on the 7th. There had been persistent northerly flow from an older system for many hours. At 1200 the LAURA PANDO reported 38-ft swell waves near 40°N, 23°W. At 1800 the AMERICAN LEGEND at 50°N, 12°W, had 43-kn northerly winds but only 15-ft waves.

The cyclone initially moved northward, but on the 8th it curved westward, then southward, and finally northward again on the 10th. On the 8th the MONT JOLY (50°N, 19°W) had northerly 50-kn winds with 26-ft seas.

The winds west of longitude 15°W had been northerly for some time (fig. 53) and at 1800 on the 8th the GEESTSTAR (47°N, 19°W) reported northerly 44-kn winds, 33-ft seas, and 46-ft swells. At 0000 and 1200 on the 9th OWS Romeo measured the seas at 33 ft. At 0600 the GEESTSTAR was still sailing into 25-ft seas and 41-ft swells. Other ships had winds in the 40-kn range and waves between 20 and 30 ft.

By 1200 on the 10th the storm was near Brest at 990 mb. Romeo now had 20-ft seas and a ship off Lisbon had 25-ft waves. By the 11th another center had formed over Germany and rapidly sapped the strength of this storm.

Figure 53.--The cloud pattern west of longitude 15°W portrays the persistent northerly winds that stretched from Iceland to the Azores.

A frontal wave formed over the St. Lawrence River Valley on the 9th. It traveled northeastward and was south of Kap Farvel at 1800 on the 11th. It was 994 mb at 0000 on the 12th. A ship at 56°N, 39°W, reported 41-kn winds with 21-ft seas. Fishing vessels near Iceland were finding gales with seas up to 20 ft south of the island, but on the 13th the ARNI FRIDRIKSSON off the northwest coast reported 50- to 60-kn winds from the northeast several times. No waves were included.

On the 14th a trough was rotating through the southern circulation, and by 1200 a 988-mb LOW had formed to become the primary storm near 51°N, 19°W. The DART CANADA (49°N, 15°W) had 47-kn winds and the AMERICAN ARCHER (50°N, 28°W) had 25-ft waves. OWS Romeo had 26-ft seas on the 15th that continued into the 16th. The GEESTSTAR reported 52-kn westerly winds with 33-ft seas at 0600, while Romeo reported 30 ft. The upper air LOW was quasi-stationary near 50°N, 15°W, and the surface LOW was moving slowly counterclockwise around it. On the 17th another LOW was moving around the southern part of the circulation. This weakened the storm, and it slowly deteriorated.

This was a long-lived cyclone. It originated as a heat low over the western Great Basin on the 14th. It moved slowly eastward across the sun belt and crossed the east coast south of Cape Hatteras on the 21st. It started expanding as it moved over the Gulf Stream. There were a few gales on the 22d. The CGC EAGLE south of Cape Cod found 40-kn winds. The OGDEN CHAMPION (34°N, 74°W) contended with 50-kn winds. A double center developed on the 23d (fig. 54) and persisted until the 25th, while there were gale reports. At 1200 on the 25th the 996-mb storm was near 46°N, 55°W. On the 26th there were several vessels southeast of Cape Race that reported winds over 40 kn and waves near 20 ft.

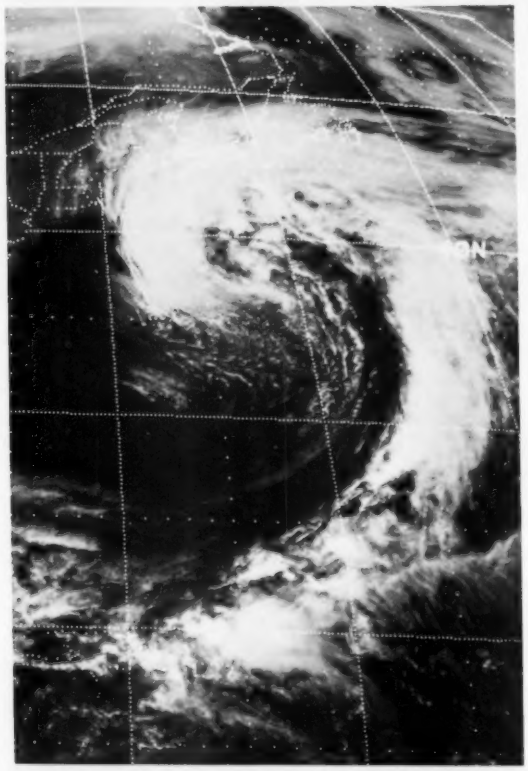


Figure 54.--The surface analysis using ship reports indicated the two surface centers near 41°N, 63°W, and 38°N, 60°W.

The storm stalled near 52°N, 28°W, on the 27th. By the 29th another center had formed, which moved northward to dissipate. During this time Charlie was measuring gales with waves near 20 ft. A German ship near 53°N, 34°W, quoted 48-kn winds with 20-ft seas. The AMERICAN LEADER (53°N, 33°W) found 40 kn and 23-ft waves.

Tropical Cyclones--Tropical Storm Arlene was spawned from a disturbance that had moved eastward through the Caribbean for several days. Early on the 7th it was classified as a tropical depression. A short time later tropical storm Arlene was born about 25 mi south of Cayman Brae in the Cayman Islands (fig. 55). Moving northeastward at about 10 kn, Arlene's winds climbed to an estimated 40 kn, with stronger gusts, before she moved across eastern Cuba early on the 8th. She crossed the coast about 60 mi south of Camaguey and left it about 60 mi east-northeast of Camaguey. Arlene dumped heavy rains over eastern Cuba and was now spreading them into the central and southeastern Bahamas. She weakened slightly, but regained tropical storm strength once over the warm tropical waters. On the 9th Arlene moved out into the open Atlantic and her remnants were absorbed by a nontropical low.

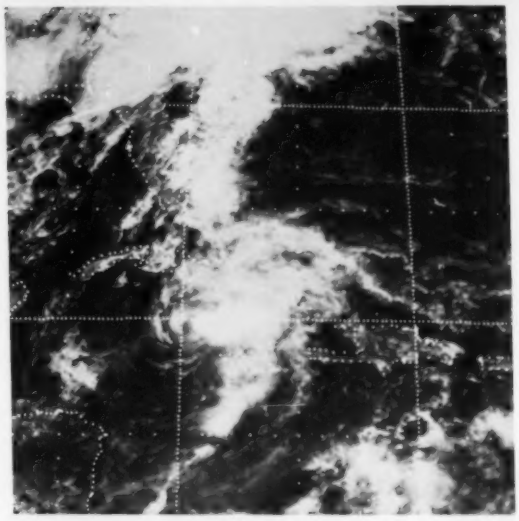


Figure 55.--Tropical storm Arlene was near 20°N, 80°W, at 1700 on the 7th.

Casualties--May 6 was a bad day with fog, and there were two collisions. The Staten Island ferry AMERICAN LEGION and the HOEGH ORCHID collided in New York Harbor. The HELLENIC CARRIER and the LASH ATLANTICO (fig. 56) collided off Cape Henry, Va.

The fishing vessel DAY DAWN was hit by a large wave while approaching Shetland Island; she took a heavy list and sank. The Greek NAGOS encountered heavy weather 450 mi north of the Azores on the 6th and water leaked into No. 1 hold. On the 9th the British DOLPHIN POINT and the ARPOADOR collided in patchy fog off Gravesend. Fog was also involved in the collision of the DOURO and TOJARO off Spurn Head on the 13th. There was fog in the same area on the 20th, when the OCEAN CONTENDER and the REBECCA ELYSE collided. The Brazilian LLOYDBRAS had damage to deck cargo off the northeast coast of Brazil. The MARLHILL sank, on the 30th, 145 mi east-southeast of Cape Charles after heavy-weather damage while under tow of the tug IRVING BIRCH. Two days later on June 1 the LAC DES ILES sank while under tow of the same tug.

Figure 56.--The deep gash in the bow of the LASH ATLANTICO is clearly visible in this U.S. Coast Guard photograph after the fog cleared.

Rough Log, North Pacific Weather

April and May 1981

ROUGH LOG, APRIL 1981--There was no favorite cyclone path this month. The area east of Japan was the favorite area for storms to develop. There were three weak mean storm paths. From north to south they were from Sakhalin Island toward the Bering Strait; east of Hokkaido to Adak to the Alaska Peninsula; and 35°N, 180° to the Queen Charlotte Islands. The last two paths were a fair match for the climatic paths.

The normal mean sea-level pressure chart shows the Aleutian Low as a multicentered sausage-shape centered on about latitude 55°N. This month there were two distinct centers, one 1002 mb near 53°N, 165°E, and the other 1009 mb south of Yakutat. The Pacific High was near normal in configuration, but about 3 mb higher in pressure.

The departures from normal were not spectacular. There was a negative 8-mb center over east-central Kamchatka, and a negative 3-mb center near Dixon Entrance. There was a positive 4-mb center near 38°N, 135°W, which stretched to the Oregon coast.

The normal upper air flow is zonal between latitudes 30° and 50°N and was that way this month. The gradient was slightly stronger than usual. The major departures from normal were two accentuated troughs associated with the two Aleutian Lows.

Tropical storm Gerald and typhoon Holly occurred over the western ocean.

Extratropical Cyclones--This first storm came out of southern Japan. Gales and waves to 20 ft were already blowing over the Sea of Okhotsk and east of Hokkaido on the 2d. By 0000 on the 3d the storm had plunged to 964 mb near 45°N, 150°E. Several ships found winds

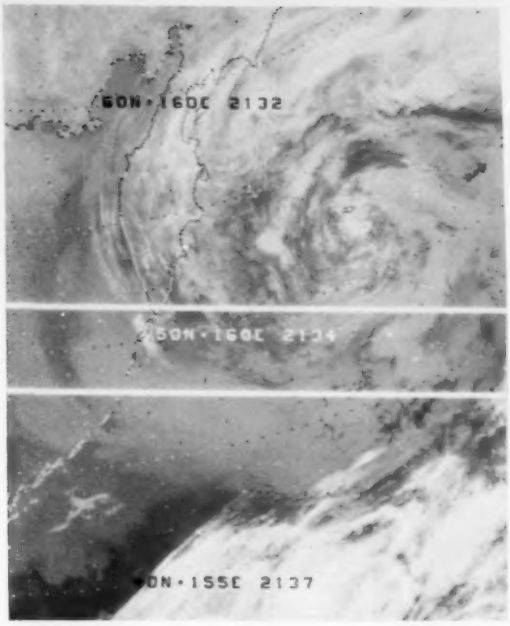


Figure 57.--At this time on the 4th it appears the storm was centered over Attu Island. The horizontal white lines are from problems in processing the data.

as high as 60 kn. Two of them were the APJ KARAN (42°N, 144°E) and the BLUE OCEAN (44°N, 148°E). The PRESIDENT MCKINLEY (36°N, 146°E) had only 40-kn winds but her swell waves were 38 ft. The storm was tracking northeastward on the 4th, generally with gales, but the OCEAN LOG (41°N, 178°E) had 70- and 66-kn winds at 0000 and 0600, respectively. The SEA-LAND LIBERATOR had 20-ft waves, and the TAKAI MARU (43°N, 163°E) had 26-ft waves.

The storm was over the Bering Sea on the 5th, and the pressure was rising (fig. 57). There were still a few gales and swell waves over 20 ft. The storm moved over Alaska on the 7th near Nunivak Island.

A frontal wave over the northern Sea of Japan on the 6th was the beginning of this storm. It developed very quickly over the Kuroshio and Oyashio Currents. At 0000 on the 8th the WGKF had gales and 25-ft waves from the southeast off Mys. Lopatka. The island station of Ostrov Rasshua measured 40-kn winds. By 0000 on the 9th the storm was 982 mb southwest of Ostrov Beringa. Some wind reports south and southwest of the center had increased to strong gales with waves up to 20 ft. On the 10th the POLLENGER and WELSH CITY both near 51°N, 164°E, had winds near 50 kn and the latter had 33-ft swells. The OGDEN FRASER also found 33-ft waves at 50°N, 168°E, on the 11th. At this time the next storm was approaching from the southwest, and this one was absorbed on the 12th.

Monster of the Month--A frontal system was moving over Japan on the 9th. At 0000 of the 10th the analysis indicated another LOW had closed around the point

Figure 58.--Nearly 23 hr later the storm has traveled to near 40°N, 148°E, off northern Honshu.

of occlusion near Tokyo (fig. 58). Later in the day two ships southwest of the center had winds over 50 kn. On the 11th the PRESIDENT TYLER (37°N, 150°E) had gales and 30-ft swells. Another ship (37°N, 155°E) at the occlusion had 41-ft swells from the south-southeast. The 12th found the PRESIDENT TRUMAN near 39°N, 157°E, with 55-kn winds and 34-ft waves. The PRESIDENT TYLER (39°N, 159°E) verified the observation with 30-ft waves. The storm was 976 mb near 45°N, 160°E.

The cyclone was pushing against a 1030-mb HIGH, but there was not the expected increase in windspeeds east of the center. Instead, the storm curved northward and disintegrated.

This storm was born near Kyushu on the 12th. By the 14th there were a few gale reports and waves of 20 ft. On the 15th the SOUTHERN HIGHWAY (49°N, 162°E) found 60-kn winds and a Soviet ship at 51°N, 158°E,

found only 2 kn less. The PACIFIC VENTURE (51°N, 166°E) north of the storm had 30-ft swell waves out of the east. There were still some 50-kn reports on the 16th, and the EASTERN TREASURER (48°N, 160°E) had westerly 41-ft swells. Others were finding 20- to 30-ft waves. At 0000 the storm was centered at 50°N, 163°E, at 970 mb (fig. 59), but it started weakening rapidly as another storm approached from the southwest.

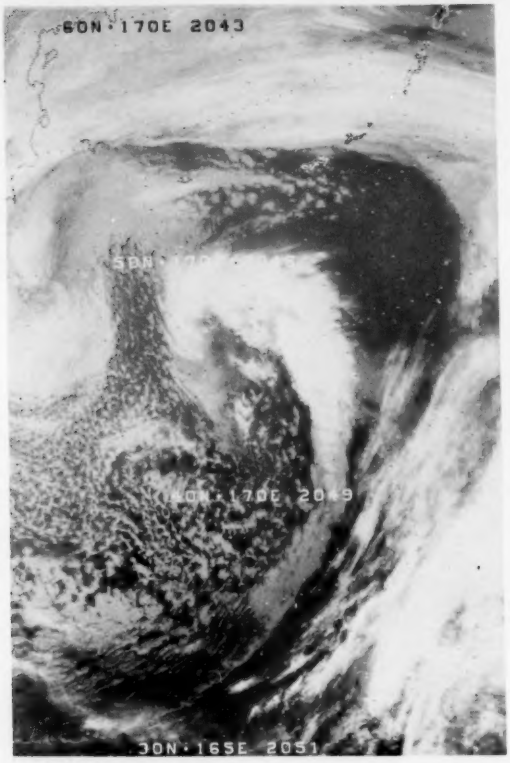


Figure 59.--The main storm center is on the left of the image at 2046 of the 15th. The hook-shaped cloud near the center of the image was associated with the occlusion of the frontal system, where another LOW had formed.

The Yellow Sea produced this cyclone. It moved across Tokyo Bay, and the HIRO MARU (34°N, 146°E) reported 55-kn winds. The 17th found the PRESIDENT JEFFERSON (37°N, 148°E) with 50-kn winds and 25-ft waves. Later the TITAN (36°N, 155°E) had 33-ft waves on her bow. The stronger winds were generally strong gales on the 18th with several finding waves over 20 ft and one near 38°N, 174°E, 33-ft swells. By 0000 on the 19th the storm was 962 mb near 50°N, 175°W (fig. 60). The Pacific High had retreated to its usual position. The KHRF (44°N, 180°) had 50 kn and 20-ft waves. The WEST JINORIWON (45°N, 172°W) found 66-kn southeasterly winds and 33-ft waves. The NEW INDEPENDENCE at 45°N, 179°W, had westerly 57-kn winds and 39-ft waves.

The storm was traveling northeastward over the

Figure 60.--The slope in the vertical axis of the storm is apparent here, about 5° of longitude toward the colder air (west).

Alaska Peninsula on the 20th and 21st. The winds were gale force or less, but there were still a few wave reports of over 20 ft. The storm was weakening and finally disappeared on the 23d.

Another storm from the Yellow Sea. At 0000 on the 20th it was over the Sea of Japan, but there were gales and 20-ft seas east of Japan. The YOUNG SPLENDOR (35°N, 146°E) had 57-kn southerly winds with 36-ft waves. Twelve hours later the winds had quieted, but the swells were still 33 ft. The storm was 984 mb near 49°N, 173°E, on the 22d. The significant weather was 20-ft waves. There was a 45-kn wind report west of the center on the 23d. On the 26th a frontal wave was moving through the southern periphery, leaving a strong gradient only on the north side of the storm. The SPRAY CAP was in that quadrant with 58-kn winds. The storm stalled near 51°N, 155°W, and dissipated on the 28th as the frontal wave continued to the east.

The Gulf of Alaska was relatively quiet this month, un-

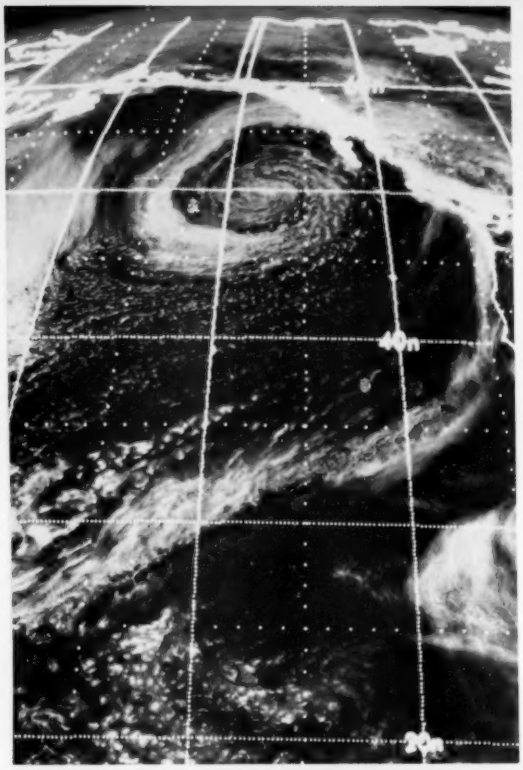


Figure 61.--The circular storm moved very little in 20 hr 45 min.

til this storm came along. It formed as a frontal wave northeast of Hawaii between two high-pressure cells. At 0000 on the 30th it was 986 mb near 49°N, 142°W (fig. 61). Ocean Weather Station Papa, a few miles to the west, had 45-kn winds from the north and 23-ft waves. The DIAMOND PHOENIX (51°N, 142°W) was carrying 58-kn winds, 992 mb, and 20-ft waves. At 0600 Papa measured 48-kn winds and 33-ft waves as did another ship 3° latitude to the north. On May 1 buoy 46004 measured 20-ft waves. The storm stalled against the beach on the 2d and fell apart.

Tropical Cyclones, Western North Pacific--Tropical storm Gerald developed among the Caroline Islands on the 15th. Moving west-northwestward from Satawan Atoll, the tropical storm crossed the 145th meridian before recurving northward. At this time, early on the 17th, winds reached a peak of 55 kn. Gerald maintained 50- to 55-kn winds as he skirted the southern Mariana Islands on the 18th. The following day he weakened rapidly as surface pressure rose to 1003 mb.

Two weeks after Gerald came to life, tropical storm Holly popped up just northwest of Lele Island in the Caroline Islands. On a west-northwestward track, Holly crossed the 155th meridian on May 1. By the 2d, generating maximum winds of 45 kn, she moved north of the 10th parallel near 150°E. Soon after this crossing, Holly began to slow and weaken. Vertical wind shear resulting from a strong westerly upper level flow was a factor in her demise on the 7th.

Casualties--The bulkcarrier AMSTELMOLEN was due Asano dock on the 6th with weather damage. On the 9th the 6,888-ton submarine GEORGE WASHINGTON collided with the 2,350-ton NISSHO MARU off Kagoshima in rain and fog. The NISSHO MARU sank within 15 min. Two crewmen were missing, but 13 were rescued.

The AEGIS LOGIC was at Sasebo on the 20th with heavy-weather damage. The cargo shifted in heavy weather on the 21st on the JAPAN CANELA, Yokohama to Los Angeles. The 2,828-ton BALTIK collided in strong winds with the EISHIN MARU in Yokohama anchorage on the 20th.

The American ferry WALLA WALLA on Puget Sound grounded in fog on the 23d. The FUHWO VENTURE was due Nagoya on the 25th with weather damage. The LIECHTENSTEIN sustained weather damage on the 25th.

Other Casualties--The Greek motor vessel JADE had heavy-weather damage during the period April 1 to 12 from Australia to Chile. The fishing vessel JUI MAN No. 3 grounded in a heavy rain squall and swells near 14.3°N, 170.6°W, on the 8th. The SILVERHAWK sustained weather damage on the 12th from Hobart to Melbourne. The SOUTHERN DIAMOND at Santiago, Chile, reported damage from the 25th and 26th. The tanker AMANDA MILLER reported weather damage at Kwinana.

ROUGH LOG, MAY 1981--This was a pacific month. There were fewer storms than usual. If there was a primary storm path, it extended from Hokkaido to south of Unimak Island. The more severe storms were during the latter part of the month. Two cyclones occurring at the same time in the first week of the month had odd paths. One started off northern Honshu and tracked southeastward for 10 days, ending near 19°N, 175°W. This cyclone was associated with a cutoff upper level LOW. The other started over the northern Sea of Okhotsk and traveled to the Bering Strait, where it turned southeastward, ending south of the Alaska Peninsula near 47°N, 160°W. This was the result of high pressure off the British Columbia coast at the surface, and high pressure building northwestward into Alaska from Canada in the upper air.

The mean sea-level pressure pattern reflected a 1005-mb Aleutian LOW near 50°N, 163°W. The Pacific High was 1024 mb centered near 33°N, 138°W.

The most significant departure from normal was the location and shape of the Aleutian Low. Normally, it is more like an east-west trough along latitude 53°N with multicenters. The primary anomaly of minus 9 mb near 48°N, 163°W, was associated with this LOW.

The upper air flow was primarily zonal between 30° and 50°N. The Aleutian Low was supported by a low center near 51°N, 166°W, in a narrow trough from a deep LOW over the Laptev Sea. A sharp ridge extended westward from Canada into Alaska.

Tropical storm Adrian became the first tropical cyclone in the eastern Pacific this year.

Extratropical Cyclones--The first significant storm

came out of the East China Sea on the 6th as a frontal wave. The cyclone intensified rapidly on the 8th after crossing Japan. There were several strong gale reports. The PACMONARCH (44°N, 154°E) found 50-kn easterly winds north of the center on the 9th. The ANDRES MAERSK nearby had 20-ft waves. There were a few gale reports on the 10th and 11th as a second LOW developed behind (west of) this one. On the 12th this LOW dissipated and the western LOW continued to develop. This second LOW turned northeastward on the 14th and tracked into the Gulf of Alaska on the 16th. The winds were mostly light, but the LESLIE LYKES and SINCERE No. 5 found 23- and 27-ft swells near 45°N, 150°W, on the 16th and 17th, respectively. The center had disappeared by the 18th.

The La Perouse Strait was the birthplace of this cyclone. The storm was east of the Kuriles on the 16th, and a Soviet ship (53°N, 161°E) found 50-kn northeasterly winds. The storm had organized a fairly large circulation, but it was only 990 mb at 0000 on the 18th. The MULHEIM (41°N, 172°W) had 39-kn winds out of the south, but there were 26-ft swell waves from the northwest according to the report. On the 19th the storm was 970 mb over Unimak Island (fig. 62). The QUEENS WAY BRIDGE (50°N, 159°W) had 45-kn winds, and the PRESIDENT MADISON (51°N, 163°W) had 40 kn. The PRESIDENT TRUMAN (54°N, 170°W) had 50-kn winds with 28-ft swells on the 20th. The storm was 966 mb over the Bering Sea. It started weakening and its area of influence decreased rapidly as another storm to the south moved eastward.

The 0000 chart of the 23d indicated a frontal wave near 44°N, 155°E, thanks to ship observations. By the 25th it had developed into a 988-mb storm with the TOYOTA MARU measuring 989 mb (fig. 63). Two ships south of the center reported 40-kn winds. A thousand miles to the east the EASTERN FORTUNE called the swell waves 33 ft. At 0600 the PRESIDENT TYLER was 800

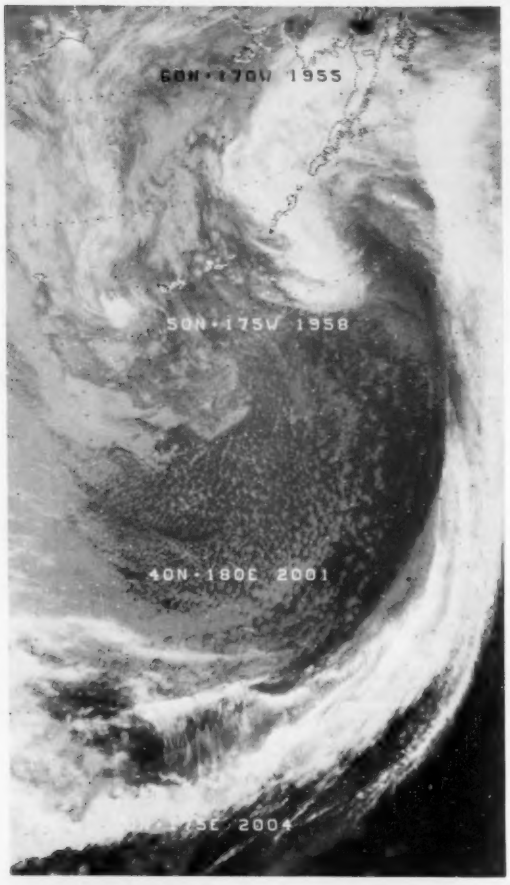


Figure 62.--As happens many times, the higher winds and waves are found beneath the cloud shield southwest of the LOW center that is associated with the area of maximum vorticity. There is an interesting cloud feature near 35°N, 180°.

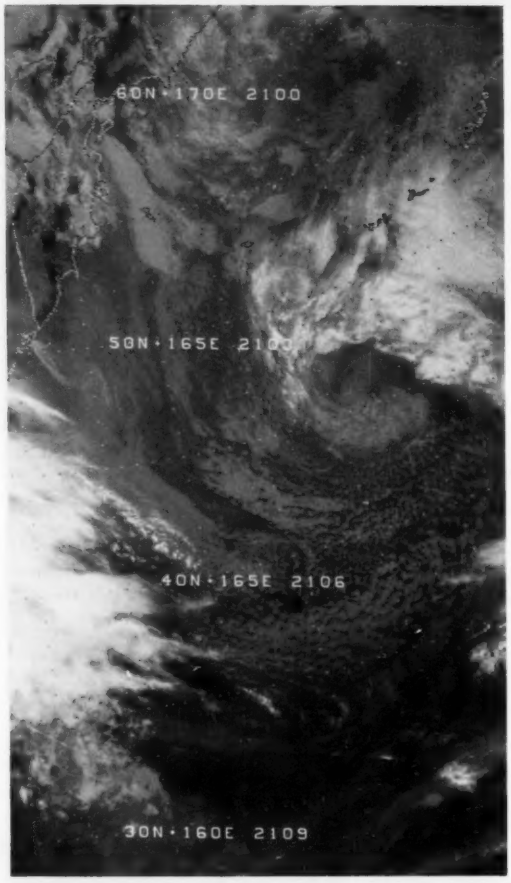


Figure 63.--There were very few high clouds associated with this storm, except to the north and east along the front.

mi south of the center with 55-kn winds from the northwest, 33-ft seas, and 46-ft swells.

The SEIYO MARU (39°N, 177°W) came in with 40-kn winds and 26-ft waves on the 26th. Twelve hours later the NEW GOLDEN PHOENIX (35°N, 175°W) had 55-kn winds with 16-ft seas. The storm turned southeastward, then eastward, and finally northeastward. The higher wind reports were gales with isolated reports of waves up to 23 ft. The storm was deteriorating on the 28th, but it took one last 52-kn swipe at the MOBIL MERIDIAN at the occlusion off Vancouver Island.

This storm was almost of tropical origin as the wave formed on a front over the southern point of Taiwan. It traveled northeastward along the southern and eastern coast of Japan. It was near Tokyo on the 24th. The DALNIY VOSTOK had sailed westward through the center and found 58-kn northerly winds on the west side. On the 25th there were quite a few gale reports with the LAKE ARROWHEAD (40°N, 150°E) finding 45 kn. Close by the BERKSHIRE had 20-ft waves, and near 43°N, 154°E, a ship had 26-ft swells. Gales continued. At 1200 on the 27th the 990 mb LOW was near 47°N, 164°E. A Soviet ship at 41°N, 152°E, had 50-kn winds. On the 29th a second center formed and yet a third on the 30th. The storm was dying.

This storm came out of Asia on the 27th. It brought rain to Korea and Japan for spring gardens. As it moved into the warmer Pacific it deepened and spread rapidly. The SAMUEL S. measured 50-kn southeasterly winds near 40°N, 150°E, and the OCEAN LOG at 32°N, 146°E, had southwesterly 62-kn winds on the 29th. The highest waves appeared to be about 25 ft. On the 30th the THOMAS WASHINGTON (44°N, 160°E) was near and east of the occlusion with 45-kn winds and 30-ft swells.

On June 1 the storm was 982 mb near 49°N, 175°E, and another circulation had formed at the point of occlusion. It became the primary center on the 2d. The winds were still gale force or less with a few swell reports over 20 ft. The second LOW went ashore on the 5th.

Tropical Cyclones, Eastern North Pacific--Tropical storm Adrian became the seventh May storm since 1966 to begin the eastern North Pacific season. He started life on the 30th, some 470 mi southwest of Acapulco. Adrian took a path toward the east-northeast. He became a tropical storm on the 31st (fig. 64). Maximum winds reached 40 kn for a short time on the 1st, but by the following day Adrian had fallen to tropical-depression strength. By the 4th he dissipated about 120 mi east-southeast of Acapulco.

Figure 64.--Tropical storm Adrian at 1510 on May 31.

Casualties--The MAYA requested a heavy-weather damage survey on the 13th at Kobe. The ASTIR requested an ice damage survey on the 18th on arrival at Aioi. The JAPAN CANELA arrived San Francisco with damage due to cargo shifting in heavy weather.

Other Casualties--The 18,400-ton PACIFIC CHARGER on her maiden voyage ran aground in heavy seas off New Zealand. Heavy thunderstorms hit the United Arab Emirates and Oman the first of the month. Several ships broke their moorings in winds up to 70 kn. In Oman 33 people were killed, and 3,000 were affected by winds and floods. Ten were killed in Abu Dhabi.

Marine Weather Diary

NORTH ATLANTIC, AUGUST

WEATHER. The Azores High is still the predominant feature of the North Atlantic. It is elongated west-southwest to east-northeast with a central pressure of 1023 mb near 35°N, 35°W. The Icelandic Low is an ill-defined east-west trough of 1009 mb south of Iceland with a second center over Cape Chidley. The summertime air temperatures are still rising with a range from 4°C over Baffin Bay to 29°C over the Gulf of Mexico. The strongest temperature gradient is between Newfoundland and latitude 40°N. The extremes range from 0° to 32°C with the sea-surface temperature closely matching the air temperature. The sea and air temperatures along 40°N range from 20°C at Lisbon to over 24°C at 50°W and back 20°C off New York.

WINDS. Over the middle latitudes of the North Atlantic (35°N to 60°N) the prevailing winds are from the southwest, turn northwesterly off the Bay of Biscay and northerly off the west coast of Portugal. North of 60°N, the winds are northerly between Greenland and Norway but southerly between Greenland and Hudson Bay. Along the longitudinal band between 15°N and 30°N the winds are northeasterly over the eastern half and easterly or southeasterly over the western half. South of 15°N, winds prevail from the south, while over the Mediterranean Sea they are northwesterly with an average force 2 to 4. Average windspeeds over the North Atlantic maintain force 3 to 5. Over the Caribbean Sea the winds average force 4 to 5.

GALES. Winds of force 8 or greater rarely occur south of 52°N, except in tropical storms. North of this latitude gale frequencies of 10 percent occur southeast of Kap Farvel with a surrounding 5-percent area extending from Kap Farvel east to 25°W. Two smaller areas observing 5-percent frequencies of gales are the Davis Strait and off the west coast of Ireland.

EXTRATROPICAL CYCLONES. During August, principal areas of cyclogenesis extend from the Carolinas to the Gulf of St. Lawrence, from Newfoundland to southern Greenland, and over an elliptical area centered near 50°N, 23°W. Extratropical storm tracks have continued to move northward. Primary tracks lead from Lake Winnipeg to Baffin Bay and from the Great Lakes into northern latitudes, extending from the Labrador Sea to the Norwegian Sea. A secondary storm track for Lows crosses Great Britain and Denmark.

TROPICAL CYCLONES. The likelihood of tropical cyclones increases as August advances. Over an average 10-yr period, 25 tropical cyclones with winds of 34 kn or greater will be found in the North Atlantic with 15 of these reaching hurricane strength (64 kn or greater). The primary track of most tropical cyclones is either west of Florida heading towards the south coast of Texas or recurving east of Florida heading northeast paralleling the Atlantic Coast states.

WAVE HEIGHTS. Wave heights of 12 ft or higher have increased slightly since July and are encountered more than 10 percent of the time over an area that lies north of 42°N and extends from the Labrador Sea to Iceland. The area is roughly circular centered about 55°N, 27°W. A 300-mi-diameter area centered about 55°N, 22°W, has a less than 3-percent chance of waves over 20 ft.

VISIBILITIES. During August, fog becomes less frequent and extensive than earlier in the summer. Ten percent or more of the observations report visibilities less than 2 mi north of a line that runs from Long Island out past the Grand Banks where it circles northward through Iceland and then southward encircling the outer coasts of the British Isles before turning northeast through the Norwegian Sea. The highest frequency of poor visibility, 30 percent, occurs over the Bay of Fundy, the Grand Banks of Newfoundland, and the southwestern tip of Greenland. Areas along the coast of Greenland and from Cape Cod to Newfoundland report 20 percent or more of the observations with visibilities less than 2 mi.

NORTH PACIFIC, AUGUST

WEATHER. The North Pacific High is the dominant pressure system at 1023 mb. It covers the ocean from Japan to North America and from the Aleutians to latitude 10°N. A weak Aleutian Low is represented by a trough over eastern Siberia and the Bering Strait. The Low over southeast Asia brings the southwest monsoon to the area south and west of Japan. August is the warmest month of the year. The mean air temperature ranges from 7°C in the Bering Strait to over 28°C over the southwest ocean. The most concentrated air temperature gradient is along 40°N. Along this latitude the air temperature averages about 21°C from 150°W to Japan. Over the Sea of Japan at 40°N it is about 24°C, and between 150°W and the California coast it drops to 14°C at the coast. The sea-surface temperature has nearly the same range over the same areas, cooling to 16°C off the coast from California to Washington.

WINDS. The mean wind pattern during August is very similar to that of July. Prevailing southwesterly winds are found from northeastern Japan to Alaska and over the South China Sea. Southeasterly winds run from Micronesia to the Sea of Japan and the East China Sea. Northwesterly winds run along the east side of the Pacific High off the West Coast of the U.S. On the southern side of the High, the northeasterly trades lie some 600 to 800 mi off the southwest coast of North America and extend westward to Micronesia. Windspeeds average Beaufort force 3 for most regions of the Pacific. However, average windspeeds of force 4 are found in the following areas: Central Bering Sea, the east side of the Aleutians, south and east of Hawaii, and off the Northern California coast.

GALES. The frequency of gales is at a minimum this month with all regions reporting frequencies of less than 5 percent.

EXTRATROPICAL CYCLONES. The principal area

of cyclogenesis extends from the Sea of Japan to near 175°E and from 30°N to 50°N. One primary track runs through the eastern half of this area and crosses to the northwestern side of the Aleutian chain, near the Rat Islands, then eastward across the Kodiak Island and the northern portion of the Gulf of Alaska into southeastern Alaska and western Canada. A second primary track crosses southeastern Russia, Sakhalin Island, and the Kuril Islands. A secondary track extends from the western edge of the Aleutian chain northeastward through the center of the Bering Sea.

TROPICAL CYCLONES. August normally produces the greatest number of tropical cyclones across the North Pacific. The average number of tropical cyclones per year that reach tropical storm strength is 4.5 in the eastern North Pacific and 5.8 in the western North Pacific. Of these storms, 2.0 are expected to reach force 12 ($\geq$ 64 kts) in the eastern North Pacific and four in the western North Pacific.

WAVE HEIGHTS. Wave heights of 12 ft or higher have increased slightly. Frequencies of 10 percent or more are encountered in areas on both sides of the eastern Aleutian Island chain, off northern California and in an area between the Philippines and southern Japan.

VISIBILITIES. During August, visibilities less than 2 mi become less frequent and extensive over the North Pacific. Most regions north of 40°N report frequencies of 10 percent or greater. The area surrounding the Kuril Islands still has the highest frequency with half of the observations showing visibilities of less than 2 mi around the center islands. This is a 10-percent drop from the annual high in July.

NORTH ATLANTIC, SEPTEMBER

WEATHER. As autumn approaches the cyclone activity increases and moves southward especially off the North American east coast. This is the result of moderate intrusions of colder air from the continent. The Icelandic Low is centered southwest of Iceland with a mean pressure of 1004 mb and has become better defined. The Azores High is centered about 400 mi southwest of the Azores at 1021 mb. The mean air temperature has dropped from August, especially near the coasts and ranges from about 3°C over Baffin Bay to 28°C over the Caribbean Sea. Along the 40°N parallel the mean air temperature ranges from 19°C off the United States and Portugal to 22°C at 40°W. The sea temperature has changed only slightly with the 16°C isoline generally following the ship route from New York to the English Channel.

WINDS. Westerly winds prevail between 40°N and 60°N, with the exception of more northerly winds over the Bay of Biscay, the Portuguese coastal water, and the region south of Nova Scotia. Speeds across this latitude belt generally run force 3 to 5. South of 40°N, the prevailing winds, averaging force 2 to 4, are northeasterly over the eastern half and east and southeasterly over the western half. Winds are more variable north of 60°N, producing southwesterly winds over the Norwegian Sea and northerly winds over the water surrounding Iceland. At these higher latitudes the windspeeds average 3 to 5.

GALES. The frequency of gales are increasing, particularly over the northern latitudes. Frequencies of 10 percent are found just off the south and southeast coast of Greenland, while frequencies of 5 percent encompass a large portion of the central Atlantic north of 45°N. South of 40°N, winds of force 8 or greater are unlikely to be encountered except in storms of tropical origin.

EXTRATROPICAL CYCLONES. The frequency of extratropical cyclones is increasing and occasional severe storms may be encountered. The primary area of cyclogenesis extends from some 300 mi off Cape Hatteras to Newfoundland and east-northeastward to a point near 55°N, 25°W. Another area of major cyclonic development is off the northeast coast of Iceland. Since August, the extratropical cyclone tracks have shifted slightly south with primary tracks leading from off the northeast coast of the United States and Newfoundland towards the Norwegian Sea. Other primary tracks lead from the Great Lakes across James Bay to the Davis Strait and across southern Scandinavia. Secondary tracks cross the Bay of Biscay into the northwestern Mediterranean Sea.

TROPICAL CYCLONES. September is the peak season for tropical storm activity. September will average four or five tropical depressions that will reach tropical-storm strength with two or three of these reaching hurricane strength. Since 1871, the number of storms occurring in September has ranged from one to eight per year.

WAVE HEIGHTS. The frequency of wave heights 12 ft or higher has increased markedly as compared to the summer months. Frequencies of 10 percent or more extend from the Labrador Sea to the Norwegian Sea and as far south as 39°N west of the Azores. The highest frequency of 30 percent appears along a band 300 to 500 mi wide that extends northeastward from near 50°N, 32°W, to a point some 150 mi southeast of Iceland. This approximately same area south of 60°N is encompassed by a 5-percent probability of waves over 20 ft.

VISIBILITIES. The frequency and intensity of poor visibilities continue to decrease. Percent frequency of visibilities less than 2 mi exceeds 10 percent over the Bay of Fundy, the Grand Banks and coastal regions of Newfoundland, coastal regions of Greenland including an area that extends some 800 mi southeast of Kap Farvel, the Greenland Sea, northwestern Norwegian Sea, and British coastal waters. An area east of Cape Race has a frequency of 20 percent of the observations with visibilities less than 2 mi.

NORTH PACIFIC, SEPTEMBER

WEATHER. As autumn approaches the Aleutian Low moves southward over the Bering Sea and Gulf of Alaska as a closed 1007 mb circulation centered near Bristol Bay. The North Pacific High has started retreating eastward and is 1022 mb near 35°N, 145°W. The southeast Asian Low is filling and the southwest monsoon disappears. The mean air temperatures have decreased from the middle latitudes northward. They range from 3°C over the Bering Strait to 28°C over

the southwestern ocean. Along latitude 40°N the mean air temperature ranges within a degree of 20°C west of 140°W. Between 140°W and the California coast it decreases to 15°C. The mean sea-surface temperature ranges from 6°C through the Bering Strait to 28°C in the southwest ocean. Along latitude 40°N the sea temperature averages about 21°C west of 140°W, decreasing to less than 16°C at the California coast. The 98-percent range is generally about 4°C either side of the mean.

WINDS. The circulation pattern has begun to take on winter characteristics as the Aleutian Low becomes established again. Mean windspeeds have increased since August, with winds north of 40°N averaging force 3 to 5 and force 2 to 4 south of 40°N. Mean northerly winds are observed over the Yellow Sea, Sea of Japan, Bering Sea, and off the western coast of the United States and Mexico. South of 35°N, between 130°W and 130°E, prevailing winds are from the eastern quadrant while southwesterly winds prevail across the South China Sea. Westerlies prevail on the north side of the Pacific High north to the Aleutian Islands from Hokkaido into the Gulf of Alaska.

GALES. The frequency of gales increases slightly in September, particularly along the southern coast of Alaska. Frequencies of 5 percent cover the northern end of the Gulf of Alaska, Bristol Bay and the Bering Sea to as far west as 175°E, and south of the Aleutian chain from the Fox Islands to the Rat Islands in a band about 300 mi wide.

EXTRATROPICAL CYCLONES. During September, the principal area of cyclogenesis has decreased in size as compared to the summer months. It includes Japan and extends northeastward to near 50°N, 170°E. One primary track runs from near Tokyo to the Gulf of Alaska with a second one paralleling the first, from near 42°N, 178°E, to near 52°N, 145°W. A secondary storm track branches off the first primary storm track across the central Aleutians. Other secondary tracks extend across southern Sakhalin to east of the Commander Islands and across the northern portion of the Sea of Okhotsk.

TROPICAL CYCLONES. The frequency of tropical cyclones across the North Pacific in September nearly equals the peak in August. On the average 4.1 storms per year reach storm strength in the eastern North Pacific and 5.6 in the western North Pacific. Of these storms 1.8 will become hurricanes in the eastern North Pacific and 4.1 typhoons in the western North Pacific. In the western ocean these cyclones originate in low latitudes in the vicinity of 160° and travel westward. Near 130°E about one-third will turn northnortheastward while the rest continue into the South China Sea. In the eastern ocean the cyclones develop west of Guatemala and travel westward or turn northward to Baja California in equal numbers.

WAVE HEIGHTS. The number of areas where wave heights of at least 12 ft are observed 10 percent or more of the time is increasing. Frequencies of 10 percent are observed in most areas between 40°N and 60°N and between the Kuril Islands and the Queen Charlotte Islands. Similar wave regimes are observed off northern California and Vancouver Island and areas of the East China Sea and the Philippine Sea.

VISIBILITIES. A noted improvement in visibilities occurs over the North Pacific from the previous month. Visibilities of less than 2 mi now occur only 30 percent of the time along the Kuril Islands and southwest of Kamchatka, the worst area. Frequencies of 10 percent or more are roughly confined between 40°N to 60°N and 150°E to 135°W excluding the Gulf of Alaska north of latitude 55°N. Frequencies of 10 percent also occur along the California coast and in the northeast Sea of Okhotsk.

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